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AVIATION

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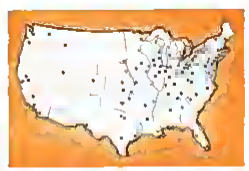

Westinghouse

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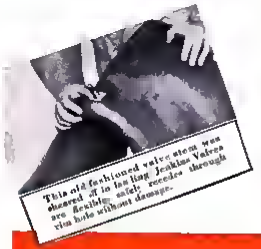

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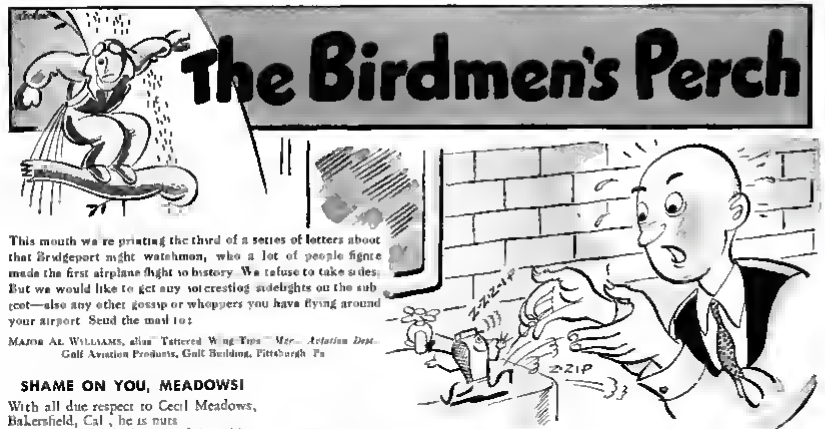
The Birdmen's Perch



This month we're printing the third of a series of letters about that Bridgeport night watchman, who a lot of people figure made the first airplane flight in history. We refuse to take sides. But we would like to get any interesting sidelights on the subject—also any other gossip or whoppers you have flying around your airport. Send the mail in!

MAJOR AL WILLIAMS, alias "Tattered Wing Tips" — *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

SHAME ON YOU, MEADOWS!

With all due respect to Cecil Meadows, Bakersfield, Cal., he is nuts.

The learned Meadows said (see May "Perch") that a fly lands on the ceiling at the top of a loop. He must be blind.

A fly is an acrobat and goes almost straight up, puts his two front feet on

the ceiling, and then flies his hind-end up. Furthermore flies can shoot up at an angle of over 90 degrees. In other words, they can take off almost on their backs.

Maybe flies in California are different from our Massachusetts flies. I hope so. I hate to see a man talking through his hat.

—Robert Cotman (Slip Stream Slim)
Woburn, Mass.

MORE DOPE ON "FIRST" FLIGHT

It was with considerable interest that I read the two contributions of "W. T." and "A. S." regarding the questioned flight of a Bridgeport night watchman back in 1900.

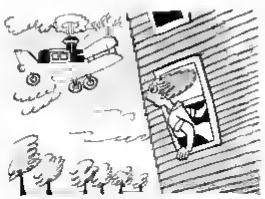
It so happened that the night watchman, Gustave Whitehead by name, *did* fly before the famous Kitty Hawk affair.

Whitehead had considerable experience as an airplane designer before 1900. He actually flew a steam powered plane in Pittsburgh in 1899, and had built over fifty machines before the beginning of the century.

His first Bridgeport flight was made in August, 1901. It was very short. And because the crowd was too curious, Gus decided from then on to make his flights with the birds, before the folks woke up.

Numerous test flights helped him iron out imperfections in his ship. Then, on the memorable morning of January 17, 1902, when the plane felt better than usual, he decided to attempt a flight to Long Island, about twenty miles away.

Everything was going smoothly when a second idea popped into his head.



Could his plane make a turn in the air? Slowly he speeded up his right motor and turned the crude rudder. The ship responded and swung in a wide arc to the left. When he was again headed toward his point of departure, he neutralized the controls, and the first turn ever made in a man-made flying machine was completed.

Whitehead was forced, by lack of finances, to end his flying experiments that same year. His backers, wishing to make a million on the invention, no matter how crude, withdrew their support when Gustave insisted on carrying his brain-child to perfection.

—John P. Runyon, Plainfield, N. J.

THIS MONTH'S WHOPPER

After reading about how your Gulf Aviation Gas makes cows act, all I got to say is "Bah."

All the dern stuff is good for is to ruin good razors. Huh? How come? Well, I'll tell yuh, it's this way. I had me one of those electric razors and I thought it could use a bit of oilin'. Well, I got all set and reached up on the shelf for a can of oil, and by mistake got a can with some Gulf Aviation Gas in it.

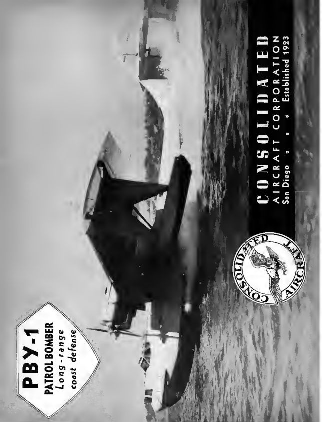
Well, Sir, I dropped a few drops of that gas on my razor and the cussed thing jumped right out of my hand, run up my face, and gave me a shave and haircut before I could set the can down and try to ketch the thing.

I made a grab for it and it slipped out of the way and run out in the yard and cut the grass and trimmed the hedge before I could get over my surprise. Then, I chased out there after it and when it seen me a-comin' it run over in the neighbor's pasture and sheared ten of his sheep.

But I didn't intend to let no razor of mine git away, so I took right after it, but as soon as I got over the fence it spotted me and took out again. Well, the last I see of the ding-busted thing, it was chasing two big jack rabbits.

Yesterday, I heard that all the jacks in the county was runnin' around stark-naked. Yours in mournin' for a gone razor.

—Carl W. Nitsh, Legion, Texas



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OLDEST AMERICAN
AERONAUTICAL MAGAZINE

AVIATION

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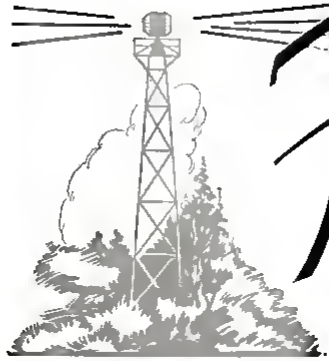


Flashes

From the Skyways of the World

» HEARD A FINE STORY THE OTHER DAY that you may take or leave as you see fit. Seems that a w k airplane designer going cross country in one of his latest pursuits was flying between cloud layers—no ground and no sky in sight and darned little horizon. Presently he sighted a speck ahead, which soon proved to be a private cabin job milling along in the same direction at a good 120. Thinking to show the other pilot what a really good airplane will do he rolled the pursuit over on its back and passed by inverted. The other pilot took one look, went goggle-eyed and, thinking that he himself must be flying upsidedown, promptly turned his own ship over on its back!

» COMING BACK from Bermuda the other day on PAA's Bermuda Clipper (see page 24) the ship's pool on time of arrival at Port Washington was won by Lawrence de Neufville of Reuter's. The keel touched the water of Manhassett Bay at exactly 4:07 by the ship's chronometer, which corresponded with the number he had drawn out of Purser Blackman's hat half an hour before. His ability to pick winners netted de Neufville just $25.—a tidy profit on a pleasant trip.

» IN SEATTLE RECENTLY, on a high pressure flying junket, we got quite a kick out of watching Dick Rummel and the other United traffic boys trying to explain to would-be customers that the line just didn't have enough equipment to run third and fourth sections on every schedule. The Mainliners have really gotten that popular with the public.

» AND AT BOEING'S PLANT we found Harold Mansfield, demon publicity purveyor, resting comfortably in a padded cell after having personally counted all the rivets to be used in the new Pan American Clipper. Mansfield stated with authority that there were exactly 487,563 rivets on the job (and he wouldn't let us fudge and claim an even half million). He is starting now on the bolts and nuts, which should be an easy job because he's already well experienced.

» ALSO IN SEATTLE we bumped into Jack Frye, Paul Richter, Walt Hamilton, Jack Franklin, John Molitor, and most of the rest of TWA's top men, all up to see about the 307s now abuilding. Which must have left TWA without any personnel except a few pilots and stewardesses,—but at last reports the Lindbergh Line was still very much on the job.

» ANYONE WHO HAS EVER TRIED to open up and use his fountain pen at 10,000 ft. will appreciate American Airlines' Bill Littlewood's efforts to interest fountain pen manufacturers in an altitude-proof pen. Reports indicate that at least two large pen manufacturers are at work on the job and we hope to have something encouraging to report presently.

» HOSPITALS IN THE AIR—by registered nurses—were the topic of discussion at a recent meeting at Burbank's Union Air Terminal. Paul Mantz, Amelia Earhart, Lauretta M.

In This Issue

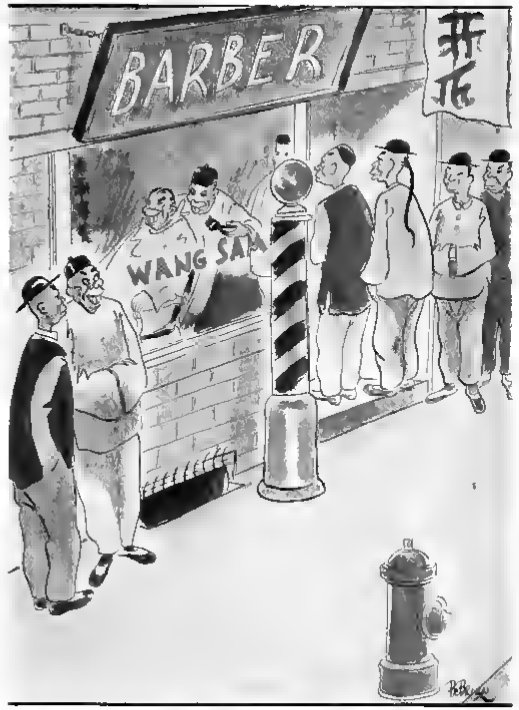
Don Fink, managing editor of *Electronics* and one of our advisers on radio problems, tells what he saw at the recent demonstration of blind landing equipment at Indianapolis Municipal Airport. . . . Another of Commander Weems' lessons on navigation for pilots this one on compasses and their behavior. . . . A pre-view of trans-Atlantic flying in some pictures taken by your editor on the first New York-Bermuda round trip for passengers in a PAA Clipper. . . . Things seen and heard on the N.A.C.A.'s Twelfth Annual Langley Pilgrimage. . . . Whoo and how to loot up your pistol for real production, by P. N. Jensen, plant manager of Curtiss-Wright's Buffalo works. . . . An engineering analysis of the economics of one, two, three or four power plants for airplanes by A. E. Lombard, Jr. of the engineering department of the Curtiss-Wright division of St. Louis. We are indebted to Mr. T. P. Wright and the U. S. Army Air Corps for their permission to publish it. . . . Also, technical details of several recent airplanes including the Lockheed 14 and Grumman's commercial amphibian. . . . The second of three articles on airports by Architect John Weller Wood Jr., will appear in an early issue.

Schimmoler (founder of the Aerial Nurse Corps of America) and numerous physicians and surgeons interested in the wider use of airplanes for transport of emergency patients attended. It is hoped that the Southern California Aviation Medical Advisory Group may be formed shortly to promote the use of aerial ambulances on a nation-wide scale, a service that should be particularly beneficial in time of sudden disaster.

» IT WAS ALL in the family when John B. Molitor, superintendent of passenger service for TWA, and Ruth K. Rhodes, chief hostess for TWA, took out a marriage license in Kansas City the other day. The ceremony was scheduled for June 30 and thereafter chief hostess as Mrs. Molitor-to-be is planning to devote her time to household duties. Sort of a home hostess!

» MUCH OF THE CREDIT for greatly increased interest in aviation in San Francisco goes to the active Aviation Committee of the San Francisco Chamber of Commerce, instrumental in bringing Stearman-Hammond to South San Francisco, and in obtaining appropriations for a large scale improvement of San Francisco airport. Recently the committee has added to its activities the publication of an attractive little monthly bulletin describing air doings in the region of the Golden Gate. Head man is Chairman Emory B. Bronte, first civilian pilot to fly the Pacific to Honolulu.

» ONE OF THE FEW "all-freight" airlines in the world is operated by one Captain U. Laurence Hope. International Air Freight, Ltd. covers England, France, Belgium and Holland. Its planes are stripped of everything except the honest flying essentials. Cargoes up to 4,000 lb. are common-



"Sam's tripled his business since he started calling himself 'The China Clipper'!"

place. Lately a race-horse was transported from an English track to a French track by I.A.F. and it is reported that the horse ran first on the following day! Capt. Hope recently spent a few days in Miami as the guest of Tom Caldwell, EAL's local traffic manager, where he concluded the purchase of four Curtis Condors.

» WORLD CHAMPION AERIAL HITCH HIKER is reported to be a girl named Molly (last name unknown) who according to her own story—started her trip in Australia, made her way somehow to South America, then thumbed her way by airplane all the way through Central America, over to Miami, and on to Washington and New York. She appeared at North Beach Airport when, after about a week of pestering itinerant flyers, finally got a lift for Roosevelt Field, where she was last seen.

» WELL WORTH KNOWING ABOUT are the awards offered by The James F. Lincoln Arc Welding Foundation for outstanding papers on application of arc welding processes to aircraft design. You may win anything from $100 up to $13,700 if you have any bright ideas on the subject. A total of $36,500 in prize money is available in the aircraft class. Time limit is June 1, 1938, and you can get all the details from the Secretary, The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio.

Side Slips

By ROBERT OSBORN

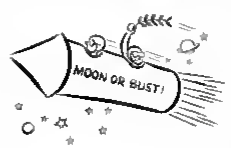
» THE RUSSIANS are transporting supplies regularly by air to their weather station at the North Pole, and are said to be designing a transport for passenger service over the Pole to the United States.

Even now very few of the passengers on the transcontinental air lines bother to turn from their magazines or newspapers to look at the Grand Canyon or Niagara Falls as their transports fly over. Think of the not-too-distant future when the passengers in the stratosphere plane won't bother to walk to the observation windows to see the North Pole!

It's a blase world, my lads, a blase world!

» WHILE WE ARE ALWAYS GLAD to see aeronautical progress and accomplishment, the establishment of this Russian airplane base at the North Pole has really been a sad blow for us. We've almost given up hope of avoiding some personal participation in the next world war.

First we thought of joining the cavalry, as the branch of the armed services least likely to see action, but they soon mechanized the outfits and started dropping soldiers, machine guns and tanks by parachute. Then we decided to bask in the sunlight and other attractions of a South Sea Island for the duration," until the powers chased us from one island to another in their haste to fortify them and build naval bases. Our next thought was to establish our dugout somewhere in the vicinity of Hudson Bay, but if it is now practical to fly to the Pole, the war will probably



decide to spend the summer season right at the spot we would pick out.

Does anyone want a passenger to pay part expenses on a rocket trip to the moon.

» THERE WAS A STIRV IN THE PAPERS RECENTLY about one of the problems of the sound technicians in an eastern broadcasting station. For one program it was necessary to broadcast the sound of water being poured from one bucket into another. The experts first experimented with rolling dry peas down a washboard next they tried blowing corn flakes along sand paper, then continued with many other schemes until someone suggested pouring water from one bucket into another, which worked very well.

Now that Messrs. Dick Merrill and Jack Lambie have been signed by a movie studio to play the leading roles in a picture called "Atlantic Flight" we are glad to see that someone has thought of the idea of using pilots to play the parts of pilots.

» THE EXPERIMENTAL FLIGHTS of Pan American and Imperial Airways preparatory to regular trans-Atlantic service are well under way. This reminds us that we haven't had any answer to our question if they are actually going to *pay* the chap who

has the job of ticket agent at Bermuda, and if so how one goes about applying for the job.

» THE INTREPID AVIATOR says that he doesn't feel so badly any more that the government made him give up flying his old Jenny, as he doesn't think it would be much use for taxi service nowadays, what with pilots hopping the ocean both ways just to bring back pictures of the Coronation.

» DAMN CLEVER, THESE PILOTS! ALSO VERSATILE. Merrill, Lambie and Browne are movie actors. Wead has authored many successes for stage and screen and Jamieson has written a number of short stories for Colliers and the Saturday Evening Post.

There are many other pilots gifted with varied talents, but the latest to achieve fame is Vodopyanoff, the pilot of one of the planes which landed at the Pole. In a Moscow theatre the curtain rose on the premiere of his play "The Dream", based on the Arctic flight, shortly before the planes landed.

SCHROEDER NAMED U. S. SOCCER PILOT, Sporting Page headline.

Daddy, is there really only *one* Shorty Schroeder?

Trans-Atlantic Preview

A YEAR AGO we went to Bermuda. We sailed from New York at three o'clock of a Saturday afternoon and by ten on the following Monday morning we lay alongside of the wharf in Hamilton Harbor. Elapsed time: 43 hours.

A week ago we went to Bermuda again. We sailed from New York shortly after ten o'clock of a Tuesday morning and a few minutes after half-past three on the same afternoon we picked up our moorings in Hamilton Harbor. Elapsed time: 5 hours, 20 minutes.

Progress, or something!—and, at the same time, an opportunity to get a foretaste of trans-Atlantic air travel, for it was our privilege to take part in the first passenger flights between New York and Bermuda on board the Bermuda Clipper on June 8-9. On page 24 of this issue will be found some pictures, and a brief account of the expedition.

By and large, it was one of the most interesting flights we have ever made, chiefly because of the quiet efficiency and the obviously excellent air- and seamanship with which it was carried out. In every department the Clipper functioned with the smoothness that marks the training and discipline of a modern battleship. Every man, from the Skipper down to the Cabin Steward, had a job to do, and did it well. Every detail of the ship's operation was accurately known during every minute of the flight, altitude, speed, position, power output, fuel consumption, fuel on board, and a hundred and one other items were continuously checked and recorded. We have made other overwater flights with Pan American, and we have always been impressed by its operating methods. They cannot be matched anywhere in the world.

The preliminary flights of PAA's Bermuda Clipper, and Imperial's Cavalier between New York and Bermuda have been remarkable, not so much in themselves but in what they portend. Fortunately, there is enough travel between the two islands to offer some commercial justification for operating airplanes over that route, but it is no news to anyone that the ultimate objective is trans-Atlantic service. Bermuda is only one jump toward Europe, and toward the conquest of the last, and most difficult link in the chain of round-the-world air routes.

But some real competition is developing in the North Atlantic. Germany put up a perfectly swell show with her catapulted flights of last year, and now has ready a new and larger airplane for similar service this summer. Rumors from France point toward plans for a service with flying boats, and it is not unlikely that recent visits of certain gentlemen from Holland

might well be connected with KLM's ambitions for over-seas extensions.

In the face of all this activity Pan American and Imperial have done well in starting their Bermuda services, and it is to be hoped that they will proceed with as little delay as possible in extending the route through to Europe. Obviously it can't be done without the assistance and the cooperation of the two governments involved. We earnestly hope that all differences of policy and of opinion will be speedily settled, for it seems eminently fitting and proper that the two English speaking nations who have the biggest stake in the North Atlantic should develop and should control its intercontinental air routes.

Please, Mr. Gray — !

BEFORE CHARGING US WITH MURDER, as you did on page 604 of your estimable magazine dated May 19, get your facts straight! Murder is a rather serious offense in most civilized countries (at least in times of peace), and before bringing in an indictment it is a good idea to base accusations on fact rather than fancy. Yet when you say that "the Hindenburg was built in the hope of using helium, but the helium was *refused by the U.S. Senate* and the people in the Hindenburg *were killed because of that prohibition*" you are definitely out of bounds again.

True, of course, that, for the time being at least the United States is in a fortunate position with regards to the supply of helium. True, also, that there are legal limitations placed upon the exportation of the gas. No evidence is available, however, to indicate that Germany ever attempted to purchase helium and was refused. In fact, it is definitely known that both Presidents Hoover and Roosevelt have expressed themselves in the past as willing to negotiate the sale of helium to Germany for use in commercial airships. There were, and still are, in fact, economic and physical difficulties in the way of selling large quantities of the gas abroad, and such things, undoubtedly, had considerable influence in Germany's decision to risk the use of hydrogen. But, in view of the facts, it seems scarcely cricket to charge us directly with the responsibility for the Hindenburg tragedy.

To Show or Not to Show? —

THAT IS A QUESTION that has been agitating a good many people in the industry of late. Two or three years ago aircraft shows were in decided disrepute, but several successful exhibits, both east and west, in the past two years, have renewed interest all along the line.

In order to sound out industry opinion, AVIATION recently circulated a questionnaire covering a few pertinent problems about the whole show business. As no one was asked to sign his name to his reply, an opportunity was given for the industry to take its hair down.

The final scores are not all in yet, but we have enough replies at hand to point up a few trends in a preliminary way. So far, 103 individuals have seen fit to send in their opinions. They represent 24 airplane manufacturers, 9 engine builders, 57 accessory people, and 13 miscellaneous personages, a fairly representative cross-section of the whole industry.

Most of them (87) definitely want aircraft shows. A big majority (91) believe that shows should be of a national character rather than confined to local distributors. One good show a year seems to be favored, as only 22 spoke for two or more shows annually. The first part of the year seems to be the acceptable time, with February and March predominating.

As for location, it is evident that most people want shows in their own particular neck of the woods. So far, no section has been predominantly favored.

Sizing up show experience—27 people thought they were highly desirable, but only 9 admitted that they had been financially profitable, 64 thought their chief value was in promotion only, 27 thought results were indifferent. Three people said they were definitely disadvantageous to their business, and 18 summed them up as "a pain in the neck."

Public education, contact with prospects, the building of good-will, and the general advertising of products, seemed to be the predominant reasons (in the order given) for holding aircraft shows. Only ten people thought that shows were of value for the direct sale of their products.

Many of the remarks that accompanied the questionnaires were interesting and covered a wide range of complaints and suggestions. Several manufacturers thought that the first couple of days of a show should be confined to the industry only, for business purposes, after which the exhibit could be thrown open to the public. Some complained bitterly about high costs for union labor in installing exhibits. A protest against shows staged by promotors outside the industry was voiced, and the suggestion was made that if national aircraft shows are to be productive of good to the industry, they should be staged and managed by the industry on a no-profit basis. Consensus of opinion was that recent shows had been well handled and the recent move toward centralizing the show question in the Show Committee of the Aeronautical Chamber of Commerce was mentioned favorably a number of times.

Although, as pointed out above, opinion on show location varied widely, there were a number of suggestions that a definite plan for rotation be adopted. Also it seemed important to some that shows be held adjacent to flying fields.

This, so far, is the industry's opinion of aircraft shows. When complete returns are in, a detailed breakdown of the replies will be made available.

1

1: The British contender for landplane Atlantic honors, the de Havilland Albatross, powered with four 500 hp Gypsy Twelves. She is now undergoing her flying trials.

2, Stuntman Rankin, winner of the St. Louis Aerobatic Competition to a stock Ryan, talks it over with T. Claude Ryan.

3, Hero of the Soviet Union M. V. Vodopyanov (right) who flew the first of four Russian planes to the North Pole on a survey expedition that will remain at the Pole a year (Soviola)

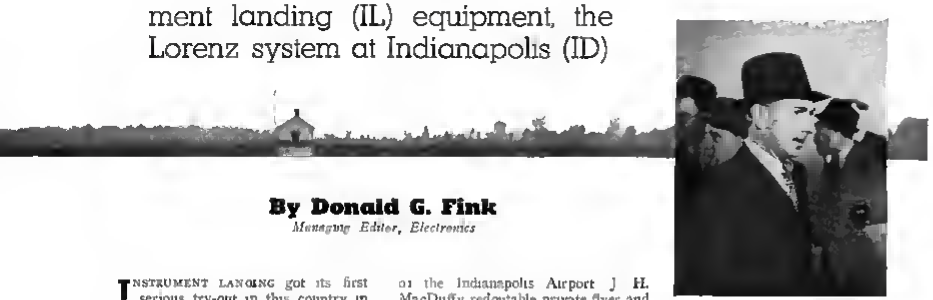
4, Highflier: Col. Mario Pezzi, who captured a new world altitude record for Italy taking it from Britain (Wide World)

5: TWA Chief Pilot Harlan Hull lands at Newark with 25 passengers in one of the line's new Douglas Skysleepers.

Camera's Eye on the News

IL at ID

The latest demonstration of instrument landing (IL) equipment, the Lorenz system at Indianapolis (ID)



Left: American Airlines test plane flying the beam at Indianapolis. Below: Fowler Barker of ATA tells the WIRE radio audience about it

By Donald G. Fink
Managing Editor, Electronics

INSTRUMENT LANDING got its first serious try-out in this country in 1933, when the Bureau of Standards system was installed for test purposes at Newark. Since that time much water has flown past Newark but instrument landing as an adjunct to commercial operations, is not yet with us. The inference is that blind-landing systems are still "buggy", not reliable or simple enough for every day use.

So when the International Telephone and Telegraph Company announced that it had imported from its German subsidiary, C. Lorenz, A. G. of Berlin, a complete instrument landing system and was prepared to demonstrate it at the Indianapolis Municipal Airport, the message fell upon a waiting world. On May 14th and 15th, the demonstration days nearly everyone interested in radio aids to navigation was present or had operatives at work. One planeload of notables came up from Washington via American Airlines, others converged from all points. During the festivities WIRE of Indianapolis staged a broadcast, in which participated Sherman Minton, U. S. Senator from Indiana, Col. Frank Page of the I.T.&T., Gould Beard of American Airlines, the pilot of the test plane, Fowler Barker of the Air Transport Association, Nish Dienhart of the Indianapolis Airport, J. H. MacDuffy redoubtable private flyer and president of Prestolite Corp., Bill Jackson, Chief of the Radio Development Section of the Bureau of Air Commerce, and Dr. E. Kramar, the inventor of the Lorenz system. Ironically at the end of the demonstration on Friday, the low ceilings on the route east prevented the Washington crowd from taking off for the return trip. Leaving at 5 a.m. the next morning the notables were heard to remark that the delay was an excellent object lesson on the need of instrument-landing facilities, which would permit completing schedules with much lower ceilings than at present.

The Lorenz Installation

The equipment for the demonstration was installed on the north east—south-west run-way of the airport. It consisted of a main beam transmitter at the north-east end of the run-way, an "inner marker" transmitter a few hundred yards beyond the south-west end of the run-way, an "outer marker" transmitter about two miles from the airport, but in line with the other two, and finally a monitoring station in the control tower, which indicated the operation of all three transmitters.

In the test plane, a Douglas DC-2 operated by American Airlines were the receiver and the course-indicator, the receiver mounted in the compartment behind the pilots, and the indicator on the instrument panel between the artificial horizon and the altimeter.

The main transmitter, a 500-watt outfit operated on 33.3 Mc., is housed in a small building, in front of which and facing the run-way are three vertical antennas, each one-half wavelength high. The center of these three antennas is energized, the others are simply reflectors for establishing the side-limits of the guide beam. The outer reflectors, spaced one quarter wavelength from the center, are "keyed" by means of a short-circuiting relay mounted in a small cabinet at the center of each antenna, producing an "A" disturbance to the right of the beam and an "N" to the left, similar to that used in the radio range system. On the beam these two signals merge into a continuous signal. The main transmitter output is modulated with a 1150-cycle tone. Careful voltage regulation of the transmitter and crystal control are used to insure a signal of constant power and frequency, since inconstant frequency changes the effect of the reflectors and the shape of the guide beam, while changes in power produce errors in the vertical indication of the guide path indicator.

The outer marker transmitter, mounted in a small "dog-house", produces a five-watt signal on 38 Mc., modulated with a 700-cycle tone, which is fed to a single horizontal di-pole antenna and keyed in 4/10-second dashes. By placing this horizontal di-pole one-half wavelength above a wire netting, which establishes the ground plane, a highly directional signal is sent vertically upward in a fan-shape pattern, the plane of the fan being at right angles to the guide-beam path. The inner marker transmitter is exactly similar, except that it is modulated with high pitched tone (1700-cycles), and is located at the boundary of the airport, whereas the outer marker is some 10,000 feet from the airport. The inner marker is keyed with 1/15-second dots.

At each transmitter is a small rectifier which detects the out-going signal, converting it to a direct-current dot or dash which is sent along wires to the monitor station at the control tower. Flashing lights at this monitor show the transmission of each dot and dash from transmitters. A phone-jack is also provided at the monitor, so that the signals may be checked by ear. The synchronism between the A and N reflection disturbance is also checked by ear, or by watching the lights. This monitor gives the control tower operator a direct indication of the operation of the entire ground system at the airport, so that he can inform pilots at once if trouble occurs.

The receiver in the plane is fed by two antennas. One receives the main beacon signal on 33.3 Mc. The receiving circuit consists of a radio-frequency amplifier with automatic volume control, a detector and an audio-frequency amplifier, the output of which is fed to headphones. A separate detector and antenna is provided for receiving the marker-beacon signals on 38 Mc. This detector feeds the 700- and 1700-cycle tones from the markers to the same audio frequency amplifier as is used in the main beacon.

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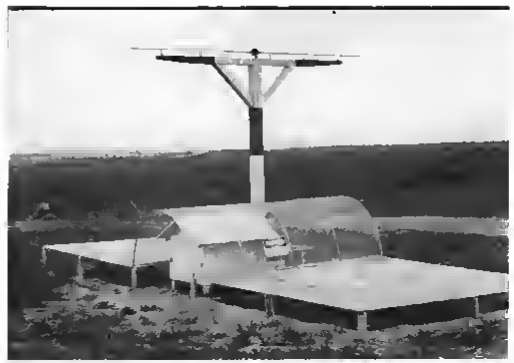
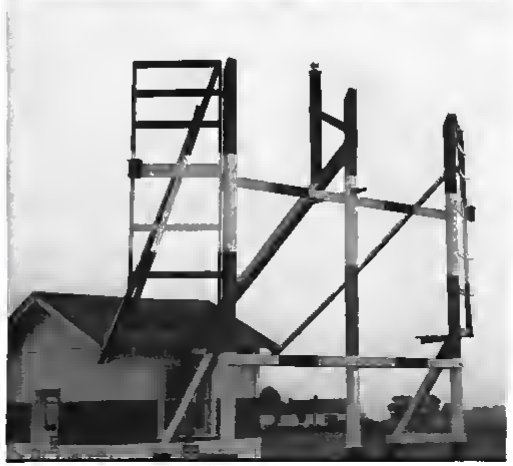
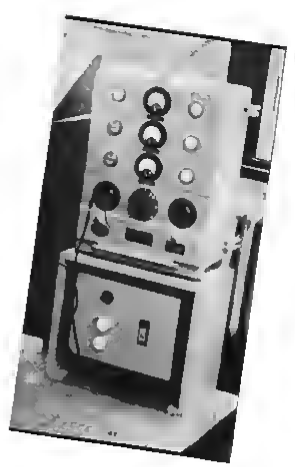




Top: The inner marker transmitter located at the edge of the airport. Center: The main beam transmitter with reflectors at either side of the vertical antenna. Right: The monitor panel in the control tower which indicates proper functioning of the three transmitters

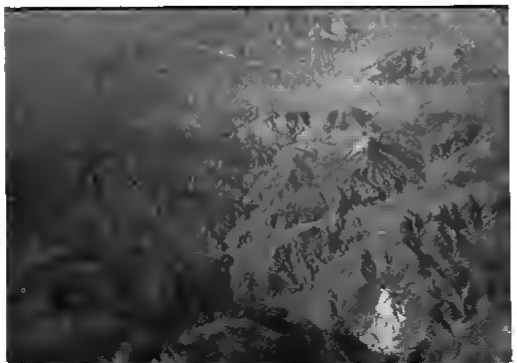


By
Lt. Comdr.
P. V. H. Weems
U S N Retired

AIR NAVIGATION

Finding Your Way in the Air

II. COMPASSES



DEAD Reckoning is the method of determining a position by keeping an account, or reckoning, of the course and distance run from a previously known position called the *point of departure*. Since the compass is the most important item of dead reckoning equipment, it will be discussed at this point.

Aircraft compasses may be of the magnetic, the earth inductor, the Sun, or the gyroscopic types. The great majority of aircraft compasses are of the magnetic type, because it is the simplest, cheapest and easiest to keep in working order.

The magnetic compass is an instrument by means of which the directive force of that great magnet, the earth, upon a freely suspended needle is used to determine direction upon the surface of the earth. The purpose of the compass is to show the course and to measure bearings. The essentials of a modern aircraft compass are:

A magnetic element which aligns itself with the earth's magnetic field. The magnetic element has a sharp pivot supported by a jewel so that it is free to turn under the action of the earth's magnetic field. This is directly contrary to marine practice, where the pivot is fixed to the bowl and the jewel or cup secured to the magnetic element.

A reference mark, or lubber's line—which may be referred to the card to indicate direction.

A bowl, carrying the above assembly, and mounted so that it cannot turn in azimuth. The bowl is filled with a non-freezing liquid, and as the liquid changes volume when the temperature changes, it is necessary to provide an expansion chamber.

An anti-vibrational suspension system is used to reduce the effect of the airplane's vibration.

A compensating device the necessity for which will be explained later, is sometimes embodied in the compass unit and sometimes mounted separately.

Aperiodic Compass

The aperiodic magnet compass is one without a "period" that is to say it returns, after being displaced from its equilibrium position, by one direct movement to the north pointing position, instead of executing a series of oscillations. Its behavior is, in common parlance, "dead beat."

The aperiodic compass has no card. The azimuth degree marks are shown on a rotatable grid-ring which carries a set of parallel grid lines running in the north and south direction, and the pilot steers his course by keeping the grid-lines parallel to the long north and south pointers of the magnetic element. The grid-ring is previously set for the desired course by releasing a locking arm, turning it till the degree mark of the course comes against the forward lubber line, and then re-locking. The pilot is thus relieved of any need to remember the figures of the course he is steering and his head is free to occupy any position without causing any parallax error in the reading.

The Compass Error

The most common reasons why the aeroplane compass does not indicate true north are:

1. Magnetic variation
2. Magnetic deviation
3. Acceleration errors
4. Vibration
5. Faulty compass

Magnetic Variation—A magnetic compass, if operating perfectly and undisturbed by outside forces, will point to the magnetic north pole. Since the magnetic pole does not coincide with the true north pole, the magnetic meridian thus established does not coincide with the true meridian. Magnetic variation is the name generally given to the angle between the true meridian and the magnetic meridian. Variation differs from place to place on the surface of the earth.

The compass cannot be corrected for variation. Therefore, since variation changes with time and place, it is imperative for the navigator to know the variation for the time and place in question. In general, the variation will not change more than about 2° in a 100-mile east-west flight and much less in a north-south flight. The value of the variation is given on maps and charts for the year of publication, and a statement of the annual change is given so that the variation to date may be easily calculated.

After this effect of variation upon the compass card is clearly understood it will be found helpful to remember the following jingle as a check upon the direction in which the variation is applied.

Variation east, magnetic least.
(Meaning less numerically.)
Variation west, magnetic best.
(Meaning more numerically.)

For example, if the variation is 5° east and the true course is 350°, the magnetic course will be least, or 345°.

Magnetic Deviation—The magnetic compass undisturbed by outside influence points to the magnetic north. In practice the compass is seldom undisturbed, but is usually affected by local magnetism within the plane. The angle by which the compass needle is deflected from the magnetic meridian by this local magnetism is known as the deviation. The deviation varies with each direction in which the aeroplane is headed, but it can be corrected so that the compass will read within 1° to 3° of the proper magnetic bearings. This local magnetism is due to magnetic induction in hard and soft iron in the plane and to the magnetic fields set up by the currents in the electric wiring. There is usually so little soft iron in the modern plane that they are small in amount and difficult to correct because of their variableness. Therefore, it is customary to make no compensation for the error caused by this type of magnetism in aircraft magnetic compasses.

Deviation due to magnetic fields set up by current in electric wires formerly gave a great deal of trouble, but with a better understanding of the behaviour of these currents this difficulty has been largely eliminated in modern planes. Alternating current has no effect on the compass. Direct current wires may be twisted so as to neutralize the effect of the magnetic fields set up. Furthermore, it is generally practicable to keep enough distance between the generator, magneto, electric wiring and the compass to ensure that the deviation due to this cause is greatly reduced, hence no attempt is made to compensate.

To compensate for deviation caused by hard iron, the only kind considered in compensating an airplane compass, small bar magnets are placed in receptacles under the compass bowl, both in the fore-and-aft line and athwartships. The correction is effected by placing these magnets so that they give an effect equal and opposite to that of the iron and steel in the plane. These small magnets close to the needles compensate large disturbances farther away.

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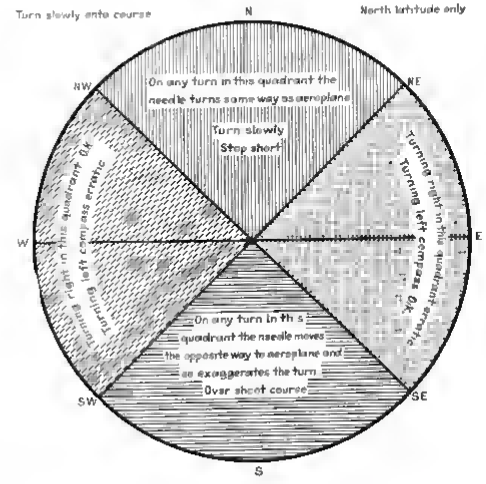


Fig. 1—General rules covering the action of the compass under acceleration.

The moorings are cast off for departure from the float at Port Washington

Navigator Officer J.W. Walker works out our position far out at sea.

Landscape. — St Georges, Bermuda, through the cloud banks that lay over the islands as we approached.

Leven West (Ivan Dimitri, to you) photographer par excellence, and Time's Jim Parten, taking it easy aloft.

Left: The meals served on board were something to write home about.

Below: The good ship Bermuda Clipper lies at anchor off the Darrell's Island Base in Hamilton Harbor.

Skipper H.O.D. Sullivan in a cheerful frame of mind on the outlook ahead.

Sea scape. — Water and clouds as far as the eye can see. Somewhere over the North Atlantic.

BERMUDA HOLIDAY

A glimpse of Manhattan through the rain at 10:30 in the morning — a swim off a sun drenched Bermuda beach at 4:30 the same afternoon. Such was the novel experience afforded your editor as one of PAA's guests on the first inspection flight June 8 S. The pictures on this page were made on the trip. The background is made from one of the navigation charts Logged Take-off Port Washington, 10:16 A.M - landing Hamilton, 3:36 P.M.; June 8, Take off, Hamilton, 10:37 A.M - landing Port Washington 4.07 P.M., June 9.

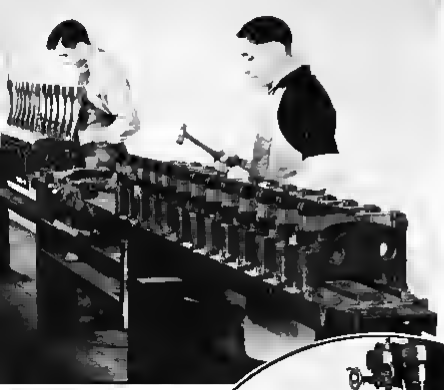
Chief Conductor PAA's Von Dusen explains the workings of a drift sight "bomb"

Taking the air on the Clipper's poop deck before a reluctant departure from Bermuda's blue waters.

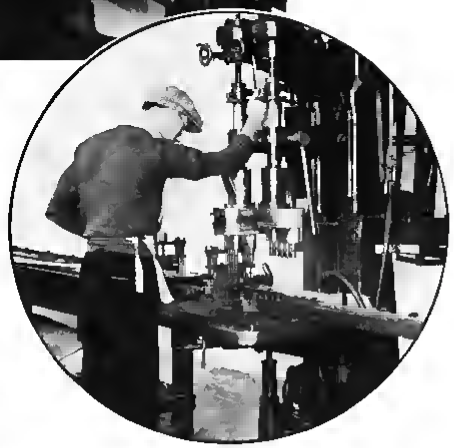
Tooling for Production

When to tool up and when not to tool up is a problem that faces every production man.

By P. N. Jansen
Curtiss-Wright Corporation, Curtiss Aeroplane Division



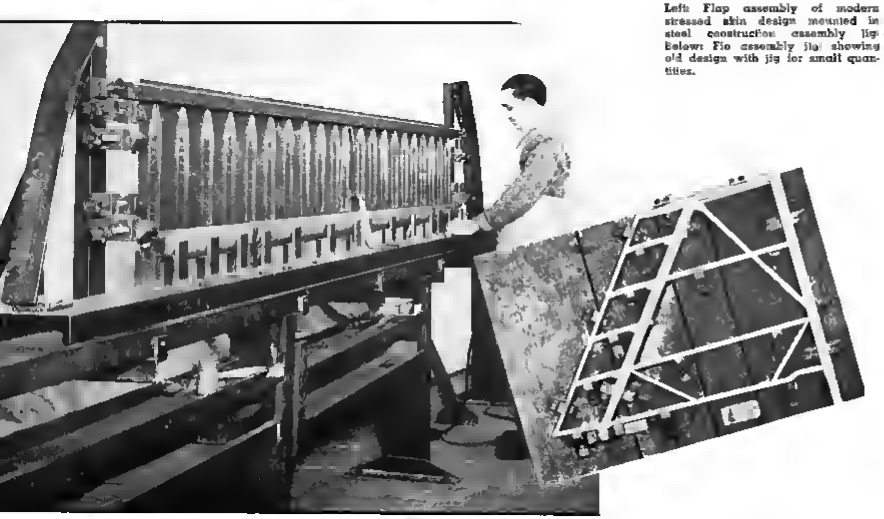
Left: Slot assembly jigs for production. Note cam action clamps to circle. A special design in multiple drill spindles with progressive feed for production. A single drill would be used in experimental work.



THE CORRECT TOOLING for production of various quantities of airplanes is somewhat of a problem. I am inclined to believe that there is a variety of policies and opinions on the subject and that throughout the industry the methods and plans vary considerably. There is some over-tooling and a good deal of insufficient tooling and planning. However, I know of no yardstick except the ultimate results in quality and cost, plus rate of delivery, if such is a factor. Through careful cost and experience records, a tool estimate curve may be established for certain quantities and types of airplanes. Because of the different methods used by various aircraft companies, I do not believe that a curve established by one company would be applicable to all except in a very general way.

Detailed airplane design has a lot to do with tooling, in fact, an airplane may be partly designed around available tools and equipment. Practically all aircraft companies have some scheme of fabricating tied up with certain equipment. One may go in for large power brakes, another may do similar work in large presses or specialize on rolling equipment and still another may go in very strongly for extrusions, castings or forgings. Under the above named conditions, the equipment is tooled to meet the requirements of design.

From this point on, we may classify tools in two groups; those required of necessity, because of need for accuracy and interchangeability and the second group for lowering cost. The necessary tools should include assembly fixtures for all mating units and especially those requiring replacement in service. For one or a small number of airplanes some fixtures are essential and although they are cheaply built, they must produce accuracy. For larger quantities, fixtures should include labor-saving devices and be made to stand wear. A high rate of output will require duplication of the same fixture or numerous sub-assembly tools, culminating with a short assembly period in a single final assembly jig.

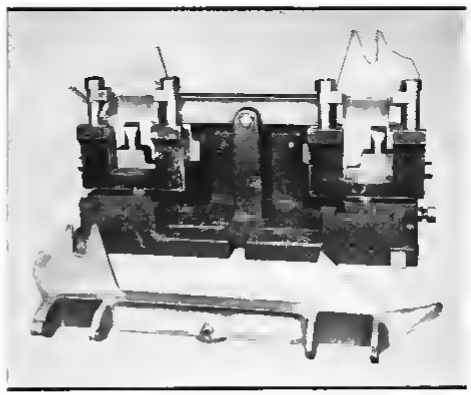


Left: Flap assembly of modern stressed skin design mounted in steel construction assembly jig. Below: Fin assembly jig showing old design with jig for small quantities.

The second group, for lowering cost, is more difficult to determine and demands careful study, coupled with good judgment. In the beginning a general plan should be worked out in meetings with Engineering, Tool Design, Factory Manager, Superintendents and General Foremen. At such meetings it must be decided how far to go with tooling, and the answer will depend upon many things, of which the following are outstanding: the quantity involved, possibility of repetition orders, equipment in which tools can be used, capacity to make tools in the allowed time, ability to acquire proper personnel, sufficient outside sources from which tools may be purchased and their ability to make deliveries on time.

From experience we have found that machine shop tools can be most readily determined. Drawings for machine parts are usually in detail, fairly accurate and too, machine operations are universally standard. Every operation can be definitely planned beforehand, tool cost can be quite accurately estimated and returns on the investment, both inaccuracy and labor saving, can be established. Blanking dies are the next best to evaluate. For each blanking die, the size and kind of press can be figured, also the cost of tools. The time element and final results can be closely estimated beforehand.

The most difficult and uncertain part is forming and drawing of metal. Experience is a great help in preparing tools for such work, but even then there usually is a tryout stage which sometimes means changes in tools, material and design before satisfactory results are obtained.



A production machine fixture with cast base. On experimental work these operations would be performed with individual setups.

In tool planning there are some pitfalls and one in particular is the concentration of too much work in one place. Not so long ago most airplanes had wood wings, steel tubular fuselages with sheet metal tail units, either fabric or metal covered. The fabrication of parts was widely distributed throughout the factory with a great variety of equipment located at strategic points. With good design, careful planning and reasonable tooling, assembling of units could start in a comparatively short time. The present designs call for practically two materials in the structure, aluminum alloy and steel. The aluminum alloy consists chiefly of sheet, extrusions, forgings and castings. Little sheet steel is used and the bulk of this material goes into bar stock and forgings. This means that most fabricating is performed by such equipment as shears, brakes, presses, rolls, etc., for the sheet metal and by a well equipped machine shop for the remainder. A good portion of the sheet metal parts require cutting and forming tools such as blanking dies and forming dies, made from tool steel, zinc or wood. Machined parts in any quantity cannot be very well produced without the extensive use of special jigs and fixtures. The element of time for a new production design has changed and assembly departments cannot start as quickly as heretofore. There is a necessity for more detailed

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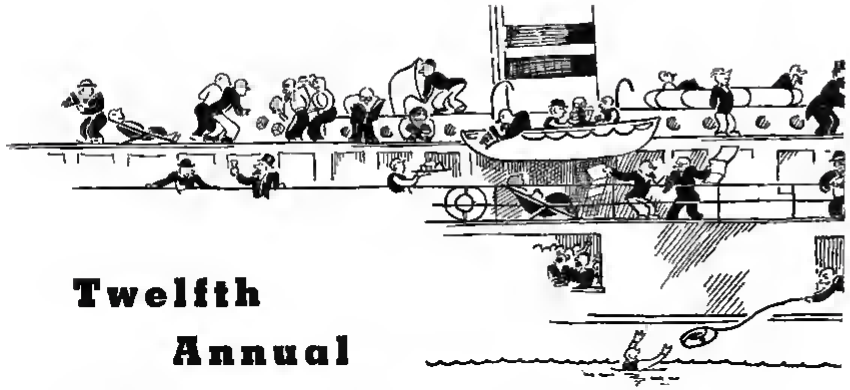

Twelfth Annual

N.A.C.A. PICNIC

It's lots of fun on the boat but real work out at Langley

LONG BEFORE the cherry blossoms began to bloom on the Tidewater Peninsula, lights at Langley Field were burning far into the night in preparation for the N.A.C.A.'s Twelfth Conference. Tired technicians taxed domestic tolerance, stumbled into bed in wee small hours. Out in the bay Crabman Arnold Doakes caught and sold a phenomenal number of crabs to be deviled to furnish food for a good cross-section of the Aviation industry, at the Full Scale luncheon. In Washington John Victory sweated over the Who's Who" of this year's two expeditions. But when Trip I set sail down the Potomac on the Good Ship "District of Columbia", all was running smoothly with everyone looking forward to a good show under the direction of Impresario George W. Lewis.

If the invited guests expected to see new research equipment costing millions they were disappointed. The committee has presented much of this before. This year the show was devoted to the practical applications of this great equipment to the little things that make big differences in the operating efficiencies of airplanes when they get going up around 200 m.p.h.

What, for instance, is the horsepower cost of protruding rivets and lap joints in wing surfaces? A very small matter at first sight, but a 182 hp. loss cannot be laughed off! And that is the power cost of brazier head rivets ⅜ in. in diameter, plus lap joints and other usual surface irregularities in a service wing of 1,000 sq.ft. area on a 20,000 lb. airplane flying at 225 m.p.h. In the same hypothetical airplane, rough wing surfaces were found to be an expensive luxury. Even a coat of paint sprayed on a perfectly smooth wing cost 91 hp. in increased drag. Translate this into speed, gasoline, consumption, payload or what you will, it all means money to the transport operator. Visions arose of airport attendants rushing out to wipe the grime off transport wings at each scheduled stop on the airlines. It is apparent that the High Speed Wind Tunnel at Langley is beginning to pay for itself.

Another manifestation of the emphasis on little things is the work with flying models which has been expanded greatly in the past year. In sharp contrast to the mammoth full scale tunnel, is a tunnel so small that it can be tilted to change the angle of attack of the model flying within. The new tilting tunnel is an adjunct to the vertical spinning tunnel which is always a sure-fire attraction for visitors. Both use the same flying models with control surfaces actuated by small electro magnets carried within the model. While the older tunnel is used primarily to study spinning characteristics the newer addition is for stability and control tests. In the latter the operator actually flies the model by electric switches which operate the control surfaces. Electric power is transmitted to the model through a trailing cable so small that it can scarcely be detected by the eye. Such factors as elevator setting for trim, period and damping of oscillation, static instability around any axis, and motion subsequent to control manipulation can be studied directly and visually in the new tunnel.

Charting the Bumps

That the laboratories are depending more and more on this type of direct observation is indicated also by the new gust tunnel which has been set up in a corner of the full scale building. Purpose is to study the flight path taken by an airplane passing through a gust. The synthetic gust is furnished by an airstream perpendicular to the flight path. The model is accelerated down a track by a catapult. At flying speed the model takes off and at that point a self contained recording accelerometer starts to operate. A photographic record is made of speed, path angle, and attitude angle. Students of archery will appreciate the high speed of the model and the arresting gear which consists of a nose hook which pierces a burlap screen at the end of the flight.

Full scale aspects of the gust problem are becoming more valuable as the records accumulate from the 160 V-G recorders installed in land and sea planes of various types in regular operation. (See "How Hard is a Bump", AVIATION, February, 1937.) A V-G recorder in the China Clipper makes a record of the gusts encountered on each Pacific flight. Others tell stories of the intensity of air bumps met by bombers, transport airplanes and other types of ships flying in many parts of the world. Thirty feet per second has been found to be the velocity of the average maximum up and down gust.

What is an Airport?

Everyone is worried about airports not being large enough for the heavily loaded airplanes of the very near future. Unless something is done about it, many large cities will find themselves without trunk line air services. (See "Airport or White Elephant?" AVIATION, June, 1937.) The N.A.C.A. has set about to find out how big a landing area should be to accommodate the next step in airplanes and the Committee is also at work on the alternate problem of auxiliary aids to take-off. (See "Land Launched Seaplanes", AVIATION, September, 1936.) Four thousand feet was found to be the necessary take-off distance for a plane with 35 lb. per sq.ft. wing loading, 10 lb. per hp. power loading, 250 m.p.h. speed, and without flaps or controllable pitch propeller. With a constant speed propeller the distance was reduced to 2,100 ft. and adding a good flap or high lift device reduced it to 1,800 ft. But this is still too much and the use of some sort of launching device, such as a catapult is indicated.

When catapulting is considered the

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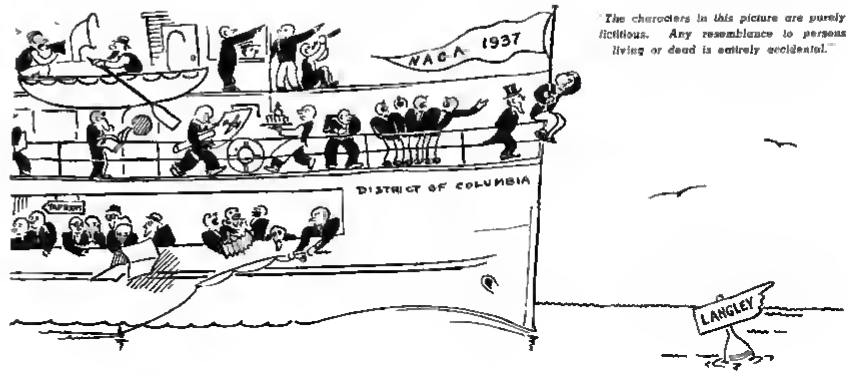


The characters in this picture are purely fictitious. Any resemblance to persons living or dead is entirely accidental.

Flying a model in the new Tilting Tunnel

By A. E. Lombard, Jr.

Curtiss-Wright Corporation, St Louis Airplane Division

HOW MANY ENGINES?

The question of power plant subdivision can't be solved by the old "Eenie, Meenie, Meinie, Mo" formula.

THE ANSWER to the question put in the title is by no means simple, but it is one that now faces every airplane designer, whether his projected design be large or small. For the present consideration, however, we shall deal exclusively with the question of the number of engines for transport airplanes operating under the U S Department of Commerce.

Inasmuch as single engine transports are not permitted to fly blind or to fly at night, they must be immediately eliminated from consideration. Twin-engine or four-engine transports have proven very satisfactory in practice and will be considered at length in this paper. The case of the trimotor is not so definitely clear cut. There has been a decided trend away from using an engine in the nose of the fuselage not only because greater aerodynamic efficiency results from the elimination of slipstream on the fuselage, but particularly because greater passenger comfort maintains due to the elimination of the noise and fumes of the nose engine; and further, the pilot vision is improved when there is no nose engine. We do not wish to condemn the trimotor to oblivion as it appears to have certain desirable features not found on other multi-engined aircraft, but we shall eliminate it from our present consideration because of the reasons cited above and thus arrive at the twin-engine and four-engine aircraft as the most acceptable types. The engines on these types will be mounted in nacelles in the leading edge.

Safety in Flight

Statistics show that rapid strides are being made in improving the reliability and safety of transport aviation; but we must continue to progress in this direction. The first consideration in designing any new airplane must be toward greater safety. Analyses of airline accidents have indicated invariably that the largest proportion of serious accidents have been due to the human element, piloting errors combined with bad weather, improper dispatching, and faulty radio equipment. None of these have any direct bearing on the relation of the number of engines to safety except rather indirectly in that the complexity of piloting technique becomes greater as the number of engines is increased.

The rule is generally believed to hold that two men, the pilot and co-pilot, can handle any twin-engine airplane, but that a third crew member, the flight engineer, is necessary to take care of the increased complications of four engines, regardless of size. For this reason much greater coordination of the crew of a four-engine airplane is necessary to effect corrective measures rapidly in an emergency. This increases the pilot's responsibility rather than lessens it. By considering the individual phases of operation in relation to piloting technique and other factors, let us examine this safety question further.

In cruising flight, on the basis of the mathematical probability of "forced landings" due to power plant failures, it has been shown by Wright and amplified by Perkins (references 1 and 2) that the relative safety of airplanes of the usual type is as follows:

1 Four-engine airplane requiring two engines for flight,
2 Two-engine airplane requiring one engine for flight,
3 Three-engine airplane requiring two engines for flight,
4 Four-engine airplane requiring three engines for flight;
5 Single engine airplane.

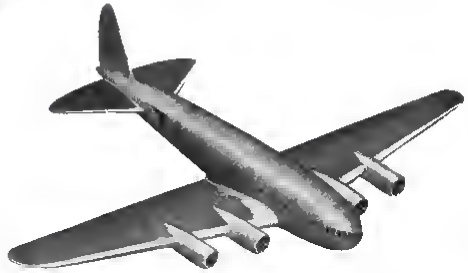
Of course, no difficulty occurs when, for example, an engine fails during cruising on a twin-engine airplane capable of flying on the remaining engine. It is only the failure of the second engine that dictates a forced landing and that puts this type in its relative position in the tabulation above.

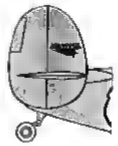
In this same connection, experience has shown that the reliability of modern aircraft power plants, as operated and maintained by the airlines today, is such that power plant failures under cruising power conditions are becoming rare. Such "failures" in cruising as do occur are often of a gradual and "technical" nature such as, for example, the overheating of the oil and possibly the engine cylinder heads due to one of a number of possible causes. In such cases, an engine is often cut off in order to save it from possible damage while it would probably continue to develop considerable power in an emergency.

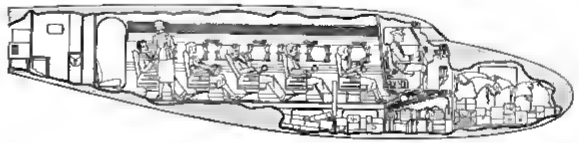
The degree of safety needed in cruising must be evaluated in terms of the length of flights contemplated and the opportunities for landing at an intermediate point when necessary. It has been established that, when operating over land as in the United States where one can land at the next convenient airport in the event of any power plant trouble, the safety in cruising is great for any modern multi-engine type with two engines, three engines, or four engines, capable of flying on fewer than all engines. In trans-oceanic flight it is probably wisest to use four-engine transports capable of flying on any two engines to preclude even the remote possibilities of forced landings due to power plant failure and we will probably see this policy, which has been established by Pan American Airways and Imperial Airways, continued by all trans-oceanic operators. In take-off a different situation rises from that in cruising.

While we have no directly applicable statistics to substantiate the claim, we believe that the greatest difficulties with engines arise during take-off, or immediately thereafter, when the power plants are operating at maximum power, and these difficulties are more likely to be of a sudden and violent nature than those which occur during cruising. Credence is given to this statement by the known reduction in

(*Turn to page 63*)







Flying Equipment

SPEED MADE GOOD IS LOCKHEED'S SLOGAN IN AIR AND SHOP

MODEL 14

By Hall L. Hibbard

Vice-President and Chief Engineer
Lockheed Aircraft Corporation

HEART BREAKER FOR MANY AN AIRLINE executive is "speed made good". Fast airplanes are frequently hard pressed to overcome handicaps of geography, weather, poor terminal facilities, schedule limitations and other factors which reduce the "speed made good" between actual traffic centers. Furthermore, a high speed transport plane is of little use to the airline operator if it exists only on the designer's drawing board. Many a new plane of the past has been markedly superior to contemporary practice at the time of design, and even during primary flight testing, but has been kept off the market by more rapid introduction of competitive equipment.

In exploring various means of reducing the time period between inception of a design and actual manufacture of the product we have thought it wise to abandon the time-honored practise of building an intermediate full scale plane for flight testing. This throws a heavier burden on preliminary testing in the wind tunnel and structures laboratory, but we feel that the science and art of aircraft design and construction have arrived at a point where complete reliance may be placed in such testing, when properly related to the store of existing knowledge. Our Lockheed 14, the first of which will be flying at about the time this issue of AVIATION is distributed, has been less than a year in process. We have not built an "experimental" model, as we feel that all necessary experimenting has been done in the wind tunnel, by full scale testing of sample structures, and through careful study of the characteristics of similar planes now in service. The first production unit of five is now nearing completion, and approximately thirty at this time have actually been sold from specifications prior to test flights of the first plane. Furthermore, the Model 14 incorporates a number of distinct innovations such as the use of Fowler type flaps, integral fuel tanks, mid-wing design, etc.

Of all-metal construction, skin-stressed, the Model 14 is a mid-wing cantilever monoplane powered with two engines and incorporating the now familiar twin-rudder tail and single spar wing. Span is 65 ft. 6 in., length 44 ft. ½ in., and height 11 ft. 5½ in. Power is supplied by two Pratt & Whitney S1EG Hornets or two Wright GR1820G3 Cyclones. Designed to meet airline needs for planes of higher speed and longer range, the ship has a maximum range with full load of 1900 miles, maximum speed of 264 m.p.h. at 8,700 ft. altitude, and cruising speed of 241 m.p.h. at 13,600 ft. altitude using 600 hp. per engine. A feature is the location of baggage compartments in the fuselage below the wing and cabin floor. In the passenger cabin there is luxurious provision for ten passengers and a stewardess. Floor to ceiling clearance is 6 ft. 3 in. All chairs are of swivel type incorporating the reclining feature.

Among other factors used to obtain the high speed is the high wing loading, approximately 28 lb. per sq. ft. of wing area. To obtain good take-off characteristics with such heavy loading, especially from fields of high altitude, and also in the interest of practicable landing speeds, an auxiliary lift device was considered advisable. For this purpose we have adopted a version of the Fowler flap giving maximum lift with minimum increase in drag. Ailerons are interconnected to droop somewhat with the flaps. This required a great deal of specialized wind tunnel testing. In this connection we are fortunate in having the facilities of the Guggenheim Aeronautical Laboratory at California Institute of Technology readily available. We have also been favored by the fact that the Model 14 is a natural progression of the Lockheed Electra and Model 12 series. This has made it possible for us to profit by the lessons learned in building and flying more than one hundred similar planes over a period of the past three years.

Our wind tunnel work involved, in addition to all customary routine testing, very extensive testing of wing root fillets, engine nacelle forms, and effect of the Fowler type flaps, especially in the landing condition. On our previous models we had abandoned wing root filleting after extensive wind tunnel testing. With the Model 14 we decided to re-examine this question entirely, as the fuselage form and mid-wing condition were relatively new. The fuselage is of deep oval section with flat sides and pointed nose. After exhaustive tests with four different types of fillets we found that the unfilleted condition was best of all. We have found it impossible to improve on a right-angle juncture of wing to fuselage side, where such a relation can be maintained throughout the root chord, especially over the top surface of the wing.

Our nacelle tests were also repeated and verified earlier results in connection with the bell-type cowling used on the Model 12. This bulbous nosed engine cowl has shown surprising efficiency and is a distinct aid in achieving the high speed of the new model.

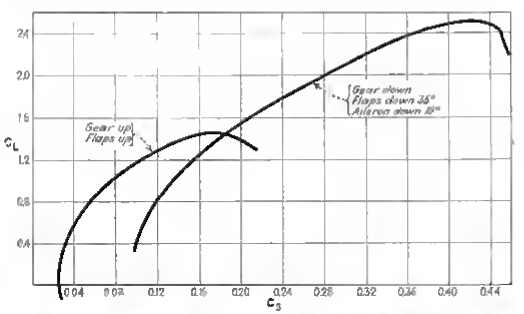
We conducted very detailed stability tests in connection with use of the Fowler-type flaps and verified satisfactory longitudinal stability for all flight conditions with CG locations ranging from 17 to 35 per cent of the

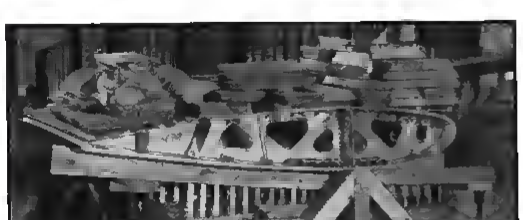
Left: Corner detail of the internal construction of the integral tanks in the wings. Above: No. 1 fuselage after its removal from the jig. Below: Center section main beam of the Lockheed 14 before assembly in jig

wing chord By limiting allowable loading so as to hold the C.G of the loaded plane between 20 and 32 per cent of the wing chord we have provided an ample safety margin In service we anticipate holding the C.G very close to the ideal position of 24 26 per cent of wing chord. This will be made more practical through use of the new Librascope Balance Computer which aids the airline loading clerk in determining automatically and rapidly the exact C G of the plane at any time during the loading operation. (See page 43)

Although the Fowler type wing flap has been used experimentally on planes of commercial type, and to some extent in regular military service, it has never before been used on a transport plane Therefore we conducted the most extensive tests on the action of this flap As is well known, the Fowler flap is essentially an auxiliary wing When not in use it retracts into the main wing When extended it drops below and behind the trailing edge of the main wing and at a greater angle of incidence, thereby contributing an independent lift increment as well as increasing the lift of the main wing proper at high angles of attack. Tests indicated that a relatively narrow chord flap gave most satisfactory results, since such shift of C G location as occurs is intensified by a wide-chord flap We also found it necessary to increase the area of the horizontal stabilizer somewhat due to the action of the Fowler flap in landing. During our wind tunnel tests of the flap we simulated the landing condition by mounting a wide board across the tunnel in such a way as to approximate the ground effect and so show effect on tail surfaces.

Extensive static load tests were also conducted on a full size wing section incorporating a Fowler flap With required maximum loading this flap was operated a great many times. During the course of such operation various difficulties were imposed, such as throwing sand into the mechanism, but no failures resulted. The flap slides out on tracks for a distance of 42 inches Its action decreases take-off run by about 18 per cent and lowers landing speed by about the same ratio





Upper: Effect of the Fowler type flaps on the full scale polars of the Model 14. Lower: A section of the wing under static test.

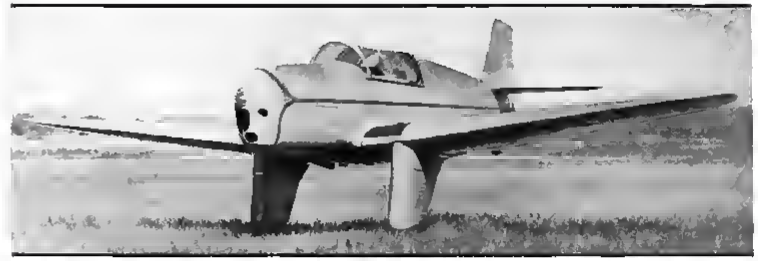
Our static testing involved numerous problems in addition to the flap gear test mentioned above. Among these was a test of the new integral fuel tanks, which are being used for the first time to our knowledge on any commercial land plane. In this test we built up a tank section of the wing, filled it with water, and subjected it to much more severe vibration action than it could ever receive in normal service. Another feature which required exhaustive testing was the dump valves incorporated in the fuel tank system to permit jettisoning fuel in the event of an emergency landing. Satisfactory development of the integral tanks has helped us to reduce both the weight and cost of the complete plane

Another unusual static test was that of a complete fuselage section with and without window and door cutouts This test was carried to destruction in both conditions and proved our calculations to be quite conservative, as well as permitting a reduced weight of structure over that required by previously accepted empirical formulae

One phase of our flight testing was done on a full scale basis and that was in connection with tail wheel drag. Due to requirements of ground clearance through use of the Fowler flaps the Model 14 tailwheel extends lower than usual. To test the drag of this unit we flew an Electra equipped with a Model 14 tail wheel extending through a trap door in the rear portion of the fuselage By means of accurate scales we determined the drag to be so slight as to render retraction unnecessary, this drag reducing the over-all speed of the plane by less than one mile per hour.

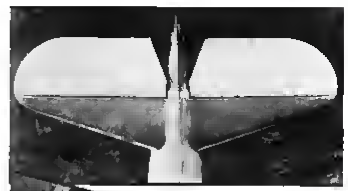
As the Fowler flap is of low drag type we designed the landing gear as a drag producing unit, using the flap almost entirely for lift. Thus at a speed of 300 m p h. the landing gear may be extended in six seconds. The flaps extend in forty seconds at any speed below 150 m p h In connection with means for operating the landing gear we conducted a very complete comparative analysis of weight and cost of the electric vs. hydraulic system and as a result have adopted the hydraulic system as it is twenty-six pounds lighter in weight and is approximately seven per cent cheaper to build. The hydraulic system also avoids draining the battery, as it functions from engine driven pumps We consider the hydraulic

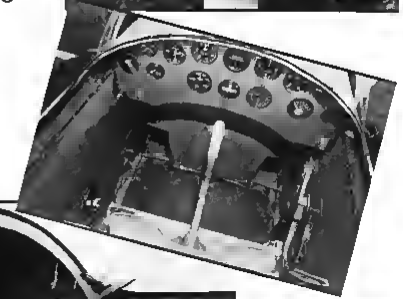
(Turn to page 75)

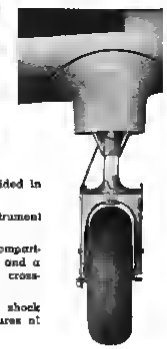


JONES S-125 Refinements

Detail Improvements Feature New Jones Model







MANY REFINEMENTS of structure detail and finish are notable on the new Jones S-125 two place sport monoplane recently announced. Of wood construction with cantilever wing and tail surfaces, the clean lines are enhanced by smooth finish and smooth intersections of the various aerodynamic units This is particularly noticeable at the tail, where the fin and stabilizer both flow smoothly into the fuselage lines The landing gear is of semi-cantilever type for light weight and ruggedness. The gear is completely cantilever below the shock strut sleeve, this sleeve being supported by welded steel tube braces. This construction is believed new Provision of eight cubic feet of baggage space is unusual in so small a plane, and additional refinement is noticed in the map compartment located beneath the pilot's arm rest Layout of instruments would do justice to a relatively large airplane spacing on the board being generous for easy inspection and servicing The entire pilot's cockpit presents an appearance of finish and is neatly upholstered throughout, provision for brake pedals, parking brake, tab control, wobble pumps, strainer valve etc, has all been made without cramping available space.

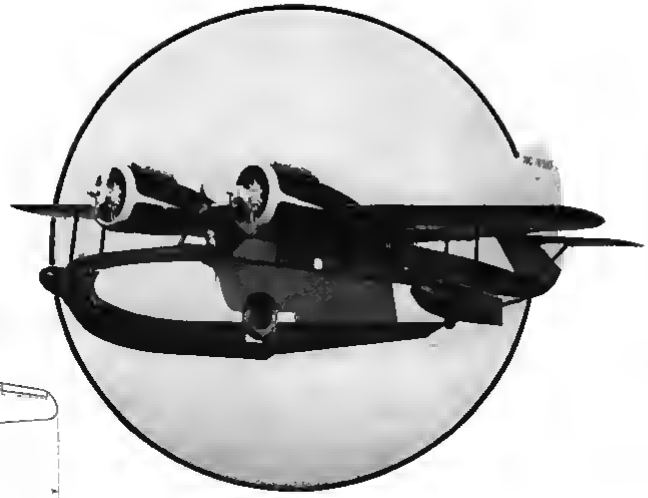
Flying Equipment

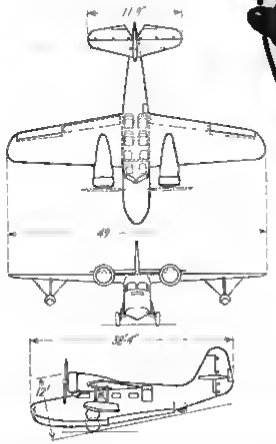
Upper—A trimming tab is provided in the left elevator

Center—Unusually complete instrument equipment is available.

Lower—A generous luggage compartment in the hull above the seat and a built-in map case encourage cross-country flying

Right—A simple and practical shock strut design is one of the features of the Jones S-125.





GRUMMAN'S
Amphibian

For Executive Travel and Feeder Service

FOUR VETERAN AIR COMMUTERS between Long Island estates and Manhattan offices decided their aircraft had seen better days and looked around in vain for new equipment. They knew about the good job LeRoy Grumman was doing for the Navy and they asked him to design an amphibian for them. A rough drawing was prepared and it sold four machines. But there was so much other interest in the design that the factory went ahead and made parts for ten. And now it looks as if they would have to make twenty. This is the brief story of Grumman's first commercial production venture.

The G-21 is structurally similar to other Grumman airplanes. The hull is semi-monocoque with water loads carried through the skin through closely spaced cross floors and bulkheads. Retractable landing gear is very similar to that used in the Navy Amphibians. The cabin is soundproofed and has accommodations for seven persons with a lavatory and luggage compartment aft. In the wing the N.A.C.A. 23012 airfoil section, talk of the Langley Laboratories, is used. Integral tanks are located in the center section. The usual type of trailing edge flap is regular equipment. Engines are two Wasp Junior "SB" units.

Specifications are as follows:

Weight

Airplane Gross Weight	7500 lbs
Airplane Empty Weight	5320 lbs
Useful Load	2180 lbs.
Maximum Oil Capacity (15 Gals.)	112 lbs
Maximum Fuel Capacity (220 Gals.)	1320 lbs

Performance (7500 lbs.)

Maximum Speed at 5000 ft.	205 M.P.H.
Maximum Speed at Sea Level	195 M.P.H.
Cruising Speed at 9600 ft. (300 H.P.)	193 M.P.H.
Cruising Speed at 5000 ft. (300 H.P.)	184 M.P.H.
Cruising Speed at Sea Level (300 H.P.)	175 M.P.H.
Maximum Rate of Climb at Sea Level	1490 Ft. per Min.
Climb to 5000 ft.	4.4 Min.
Climb to 9600 ft.	9 Min.
Service Ceiling	24,000 Ft.
Absolute Ceiling	25,800 Ft.
Absolute Ceiling with One Engine (7500 lbs.)	14,000 Ft.
Take-off Run at Sea Level	796 Ft.
Take-off Time at Sea Level	11 Secs.
Take-off Time at Sea Level (Calm, glassy)	18 Secs.
Landing Speed at Sea Level (Flaps Down)	60 M.P.H.
Fuel Consumption with 300 H.P.	52 Gals. per Hr.

Range M.P.H.	*Power*	*140 gals.*	*220 gals.*
9 600 Ft. 193	75%	506	795
5 000 Ft. 184	75%	480	755
5 000 Ft. 150	46%	740	1150
Sea Level 175	75%	460	720

Looking toward the forward bulkhead in the cabin compartment.

The heavy floor frames and bottom furnish rigidity for the hull structure making keel girder unnecessary.

The luggage compartment in the rear of the cabin is exceptionally large.

The Navy influence is apparent in the husky center section structure. (lower photograph)

NEW OIL ENDS

Startling Scientific Development

proves a laboratory triumph and practical success

THE most costly thing in your engine is now saved by the least costly thing you put into it.

You know that if your engine were lubricated *ideally* it could never wear out. That is virtually what the New Texaco Airplane Oil gives you—practically perfect preservation of bearing surfaces. We *could* say this new Oil completely eliminates engine wear—and without micrometers it would be difficult to see the infinitesimal amount that does occur

Conservatively, this can be said—aviation engineers are absolutely astonished at the results they are getting from this new Texaco achievement. Wear is so nearly eliminated that engine life is immeasurably prolonged. The interval between required overhauls is greatly extended. It becomes possible to safely operate motors at a higher percentage of their rated capacity.

It is only a question of time before all pilots who are mindful of the effect of engine wear will standardize on the use of the New Texaco Airplane Oil.

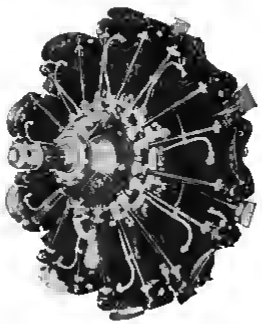
Eight years of laboratory development and over a year of widespread testing are back of this new product. It has been tested and approved by leading engine manufacturers and is now in use by major airlines.

Trained aviation engineers are available for consultation on the use of the New Texaco Airplane Oil which you can now buy at all important airports.

Drain your oil tank now and use only the New Texaco Airplane Oil. It practically eliminates wear. The Texas Company, 135 East 42nd Street, New York.

These airlines use the New Texaco Airplane Oil

BRANIFF
CONTINENTAL (FORMERLY VARNEY)
DELTA
HANFORD
NORTHWEST
PENNSYLVANIA-CENTRAL
TWA
WYOMING



TEXACO

HAZARD OF *wear*

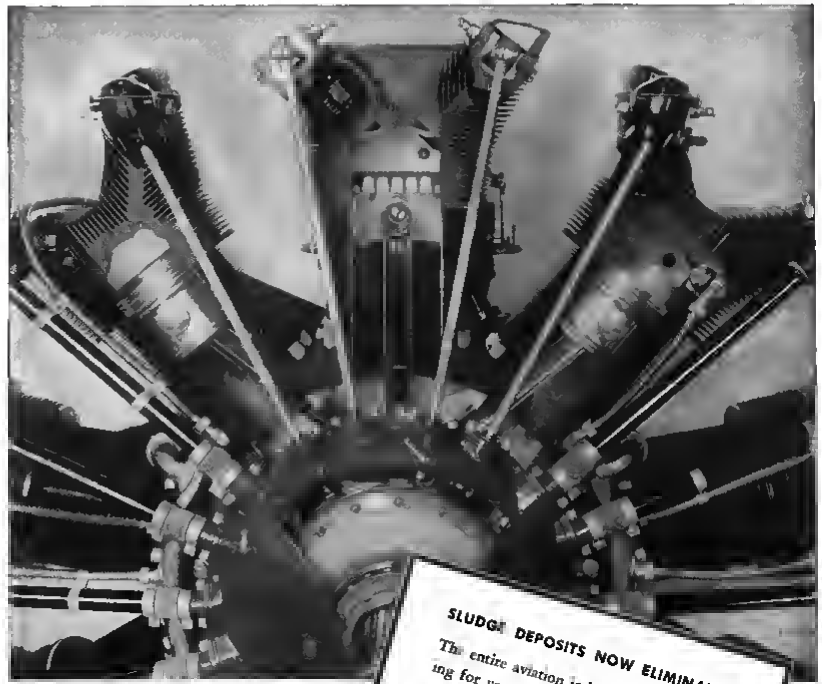


Photo courtesy Wright Aeronautical Corporation

SLUDGE DEPOSITS NOW ELIMINATED

The entire aviation industry has been looking for years for an oil that would nullify sludge. Oils which precipitate a viscous jelly-like sludge in which heavy abrasive deposits are collected, are a menace to oil lines. They directly endanger the operation of the motor itself, requiring frequent crankcase changes. This entire problem is solved by the New Texaco Airplane Oil.

Texaco Asphalt makes resilient, rugged, economical surfaces for airport runways, hangar floors and aprons, driveways and parking areas

Aviation PRODUCTS

With Foreign Builders

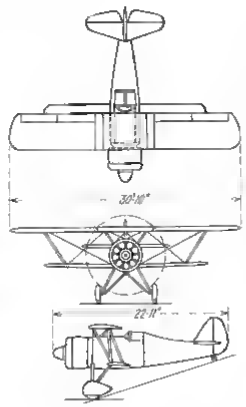
New flying equipment from overseas reviewed by Lucien Zacharoff

EVEN PERFUNCTORY ACQUAINTANCE with the problems of aircraft production abroad in recent years overwhelms one with their military character With aggression rampant on this planet, many nations, great and small, are straining the sinews of their respective industries to satisfy the domestic demand for war airplanes, a demand so all-devouring that attractive orders from other countries are frequently declined. Nor does it take profound research to see that where civil flying equipment is still manufactured—in diminishing quantities—it is decidedly of a design permitting ready conversion into fighting machines or application for auxiliary war services Such a state of affairs accounts for the preponderance of bellicose matter in this monthly survey of the foreign production scene.

AT THE BEHEST OF THE RUMANIAN GOVERNMENT, the Fabrica de Avione S E T , Bucharest, has developed a single-seater pursuit, SET-XV, modelled after various French fighter types The original order specified a machine capable of 212 m.p.h. (340 km/h) maximom speed at an altitude of 13,120 feet (4,000 m), with one 500 hp. engine, and a rate of climb of 53 feet (16 4 m) per second.

A sesquiplana, the wing unit is braced by N-struts on each side. The wing plan is rectangular, with roundei corners. The uppes wing in one panel, the lower in two There are two spors of sheet-steel sections, with dural-tube drag struts, internally braced. Each spar consists of two U-sections 1 mm. thick and one 0 5 mm. heavy corrugated sheet brace-wire, between the two U-arranged legs and joined thereto. Wooden ribs, plywood clamps in the front, fabric covering, braced center-section with six struts, two spars and two suspension wires on each side are included. On the upper wing are slotted ailerons with differential control, both can be lowered simultaneously for landing purposes

The steel-tube fuselage has wire-braced panels, made in the form of crosses, and diagonal steel-tubing in the front part, the transverse section



The SET-XV

being round, the middle oval, and tha end intersected The forward part is covered with duralumin, the rest with fabric The pilot's cockpit is on the trailing edge of the lower wing and is enclosed in a detachable hood. A concealed compartment holds the radio and breathing apparatus Two rigidly-mounted machine guns fire through the propeller disc

The empennage is cantilever, with duralumin stabilizer of two triangular portions, tubular spar and dural ribs, capable of being set immobile in flight The vertical fin is wooden, the control surfaces aluminum. All tail surfaces are fabric-covered

SET-XV has a tripod undercarriage with a split axle, the shock-absorbing strut following the lower longeron The faired 750x150 mm. wheels have shock-absorber brakes, There are swiveling tail-skid rollers held in neutral position by two rubber webbed devices

An SET wooden propeller derives transmission from a Gnôme-Rhône 9-cylinder engine of 500 hp. at 12,139 feet (3,700 m) The power plant has a NACA air-pressure equalizing cowl The steel-tube engine support is attached to the fuselage by four bolts By varying the length of this engine support different motor types, ranging from 400 to 800 hp., can be mounted The nose part of the engine cowling is built as an exhaust accumulator, resembling the type previously produced by Bristol

Other SET XV data! Upper wing span 30 feet (9.4 m), lower wing span 20 ft. (6 7 m), length 23 ft (7 m); height 10 ft. (3.35 m.); upper wing depth 3¼ ft (1 4 m), lower wing depth 3.28 ft. (1.0 m), upper wing surface 139 sq ft (12.9 m²), lower wing surface 64¼ sq ft. (5 75 m²); interar wing surface 203 sq.ft. (18.85 m²); wheel track width 6¼ ft. (2.2 m.); weight empty 2,535 lb (1 150 kg) weight loaded 3,417 lb. (1,550 kg), wing load 183 lb /22 sq ft. (83 kg/m²), power load 7 tb./1 hp. (3.1 kg/1 hp), maximum ground speed 178 m.p.h. (286 km/h.); speed at 13,123 ft. (4000 m) 211 m.p.h. (340 km/h.), at 26 247 ft. (8,000 m) 185 m.p.h. (298 km/h), landing speed 64 m p h (103 km/h).

A LIGHT LOW-WING CABIN MONOPLANE that cruises at better than 120 m.p.h is now in construction at Moss Brothers Aircraft, Ltd, a Chorley, Lancashire, concern. Although details of the new job's performance are not available at this writing, it is reported to promise an unusual range

Early trials are said to have been highly satisfactory with this plywood covered machine with a single-spar wing and trailing edge flaps There are two tandem seats, with good visibility for the pilot. Aft is to be found adequate luggage space.

Equipped with a cantilever oleo-pneumatic undercarriage and low-presure wheels and brakes, the Moss plane is powered with a Pobjoy Niagara III of 95 hp With a useful load of 400 lb, its range is likely to be 400 to 500 miles. Other vital statistics

Span 34 ft.; length 23 ft., height 7 ft; weight empty 860 lb, weight loaded 1,260 lb; fuel and oil capacity 21 and 1½ gallons respectively

AMONG THE ITALIAN FIGHTERS going into production this year is the Piaggio P-32 twin engined bomber, made almost entirely of wood Its two-spar wing is covered with ply-wood. The ailerons and the tail unit are of steel and fabric covered

Except for the steel shell of the nose, where the bomb operator is posted, the fuselage is all-wood. The undercarriage is retractable.

The power plant consists of two Isotta-Fraschini Asso XIRC of 812 hp. each, with variable-pitch airscrews.

At 16 404 ft. (5 000 m) the P-32 has a maximum speed of 249 m p h (400 km/h), on the ground it's 205 m.p h. (330 km/h.), landing speed 78 m.p h. (125 km/h.); ceiling 22 966 ft. (7 000 m.), rate of climb in 13 123 ft (4 000 m.) 15 min., weight empty 12 677 lb (5,750 kg), span 59 ft (18 m.), length 52 ft. (16 m), height 19 ft. (5.946 m.), carrying surface 71 sq ft. (59 m.²), no data available on armament

The wooden construction of this fighter provides a clue to one of the big stumbling blocks in the Italian industry—the absence of domestic raw materials. Aluminum smelting rose in that country from 12,000 tons in 1933 to 15 000 tons in 1935. In 1937 huge capital investments of two concerns, estimated at hundreds of millions of lire, may bring the smelting total to 25,000 tons which will then supply only one-half the industry's requirements. By admission of General Valle, acting aviation minister, made about a year ago, domestic manufacturing of light alloys and special steels was inadequate, despite the hothouse expansion during the sanctions brought on by the Ethiopian interlude Under great stress and strain Italian producers of semi-manufactured materials for aviation were able to furnish in 1935-1936 somewhat more than 2,000 tons of light alloys and 7,000 tons of special steels—all too insufficient

Gianni Caproni, one of the leaders of the industry holds that a complete transfer to all-metal construction would cut in half the mobilization potentialities of Italian aviation because fully half the machinery and 50 per ceot of engineers and workers are unprepared for metal work Even after a series of measures were taken for the substitution of domestic timber for the foreign and great quantities of Italian aviation plywood were supplied, General Valle pointed to the inevitability of "wider application of metals in avia-construction" as the way to freedom from imports

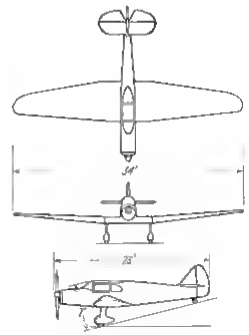
Many European experts doubt the wisdom of Italian experiments in substitution for the aviation canvas of Belgian flax a questionable mixture of Somali cotton and Japanese silk. General Valle has even boasted that insulation for magneto condensers is being made of Eritrean mica.

When serial manufacturing of speedy modern types was launched in 1936—twin engined machines attaining speeds of 273 m p h (440 km/h) and single-engine craft making 286 m p h (460 km/h) at altitudes of 13,123 to 16,404 ft. (4,000-5 000 m)—Italian industry sought to reduce to the minimum the reconstruction of its factories in the direction of increased volome of pressing and welding equipment In tha planes that have come off the line comparatively few elements display smooth lining and trimming of dural sheets There is a widespread use of wooden wings, steel fuselages

In the future perhaps the well-geared Higher Direction of Research and Experimental Work, which manages establishments at Guidonia, Vigna di Valle and Furbara, will solve in whole or in part these pressing problems which at present are counter-balanced only to a limited extent by Italy's contingent of talented designers, engineers and skilled workers

MANY EXPERIENCED PILOTS were in the crowd of curious at the Tushino Airport, Moscow, watching the test flight of LEM-2 which was put through its paces by Test Pilot N D Fedoseev Designed by Engineer Antonoff for freight carriage over relatively short distances, LEM-2 attracts attention by its uncommon appearance It is a flying wing which both glides and utilizes the 100 hp M-11 engine.

The French Potez-63



Moss monoplane (British)

Built at the Moscow Glider Plant, LEM-2 has the span of 90 ft. (27 6 meters) which exceeds the span of the ANT-35, described in the June issue of AVIATION, by nearly 50 per cent. It is intended to fly at 73 m p h (117 km/h) and land at 40 m.p.h (65 km/h) With its weight loaded of 3,969 lb (1,800 kg), LEM-2 freight compartments in the wing have capacity of 2,205 lb (1,000 kg). The fuel tanks are expected to make possible a 6-hour non-stop flight

Needless to say that in distinction from conventional gliders and airplanes, LEM-2 is entirely devoid of fuselage, its empennage attached to the wing by two light girders.

Poland now has license to produce Potez 63 fighters. As employed in the French Air Force, the Potez-63 takes on a crew of three and 2 cannons streamlined under the fuselage Incidentally, the French Army is re-equipping all its observation captive balloons, the principal innovation being an engine nacelle, enabling them to move independently in the air

Good results have been obtained in tests of motorized balloons of the Zodiac and Ridinger types, the former's speed stepped up to 31 m p h (50 km/h), the latter's to 37 m.p.h (60 km/h) The Zodiac mounts a 60 hp engine, the Ridinger a 120 hp plant and with a volume of 37 076 cu.ft. (1,050 m³) weighs 3,307 lb. (1,500 kg)

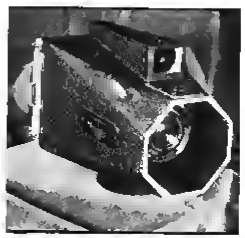
Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Skyview Camera—

Focusing model D developed for air and ground work

AN UNUSUALLY SMALL ADDITION to that exclusive family of cameras which is devoted primarily to aerial photography, the new Skyview Model D built by the Skyview Camera Company of Cleveland, Ohio incorporates in one compact unit a number of unusual features. Of neat design this camera is especially easy to handle and sight. Controls have been carefully designed for quick, smooth operation. The lens is a Carl Zeiss Tessar F/4.5 and the shutter a Compur with automatically timed speeds ranging from one second to one two hundredth of a second and including bulb and time exposures. An interchangeable back permits use of plates, cut film, film packs, or roll film. Focusing provision permits critically sharp negatives as close as 5 ft. Length of the camera with pack adapter is 9 in., weight 5 lb. 9 oz. Finish is black crystaline and price will be unusually low, under $300 with film pack adapter and carrying case.—AVIATION, *July 1937*



Skyview model D camera

Balance Computer—

Gives instant balance report on transport plane loads

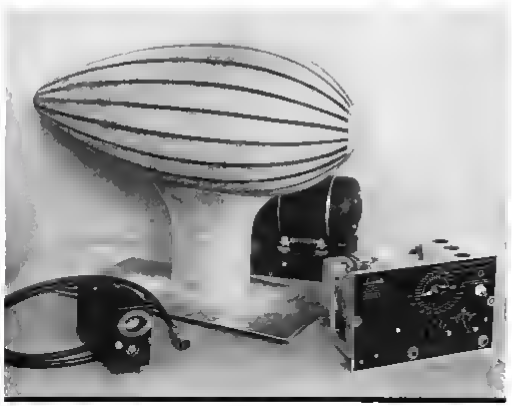
METHODS OF LOADING TRANSPORT PLANES may be revolutionized by a remarkable new instrument developed by Lewis W. Imm and now being manufactured by the Meredith Instrument Company, Inglewood, Calif. Known as the Librascope Balance Computer this instrument mechanically adds and balances all loads applied to a transport plane and gives the operator an instant reading showing gross weight, C.G. location, and a visual record of all loads applied. In practise an airline loading clerk can, through use of the Librascope, load to the ideal C.G. location for proper flight balance, thus increasing ease of maneuvering and also improving average speed through reducing use of elevator tab control with resultant drag.

Not only is the Librascope applicable to use at each loading point, but it may be carried in the plane as well and there provide the crew a constant check on C.G. location in the event passengers change location and also in connection with use of fuel from the various tanks. A further use of the instrument may be found in airline dispatching headquarters, where, through radio contact with the plane crew an added check on the balance condition and gross weight may be made by the chief dispatcher. Twenty-five are to be used by Northwest Airlines for their new Lockheed 14s.

The Librascope is separately designed for each type of plane with which it is to be used, but one such instrument will operate with equal satisfaction on any of a fleet of planes. The Librascope as now manufactured for the Lockheed 14 weighs between three and five pounds and measures 9¾x17x1½ in., incorporating a dial and setting pointer for each primary load, such as each fuel and oil tank, each baggage compartment, and each row of passenger seats, the Librascope has two reading dials to show gross load and C.G. location in per cent of wing chord. On the gross load dial a limit line will indicate the maximum allowable load and on the C.G. dial two sets of lines will indicate in one case the allowable C.G. range, and on a smaller arc the desirable C.G. range to which the plane will normally be balanced. The instrument is entirely automatic in operation and may be used by untrained personnel. A positive mechanical linkage is provided between the load setting knobs and the reading pointers. This linkage operates on the lever principle, incorporates no springs or friction devices.

Although the present Librascope as

Librascope Balance Computer



Lear direction finder

built for the Lockheed 14 shows the C G location only with respect to the fore and aft axis of the plane, the instrument may be designed to show the C G location with relation to all three axes of an airplane —AVIATION, *July, 1937*

Felt-Seal Bearings—

Both single and double row Fafnir ball bearings employ new design

ROUNDING OUT A COMPLETE LINE of aircraft bearings well known for their conformation to aircraft engineer's requirements on weight, tolerances, dimensions and proper radial and thrust capacity, the Fafnir Bearing Company, of New Britain Conn., has announced a new series of double felt seal type bearings designated the KF and KF-A series with single row of balls, and the DF series with double row of balls —AVIATION *July 1937*

Direction Finder—

New low priced instrument offered by Lear

A NEW INSTRUMENT in which is combined the Learadio R 3 Receiver and a loop arranged to act as a direction finder has just been introduced by Lear Developments Inc. The new direction finder employs as a direction indicator a device known as the magic eye" Circuits are very simple The loop housing is streamlined and has very low drag and is extremely light in weight. The loop complete with transmitter weighs 35 lb It is said that the design of the loop, together with the materials used, protects it against rain and snow static —AVIATION, *July, 1937*

Alloys for Dies—

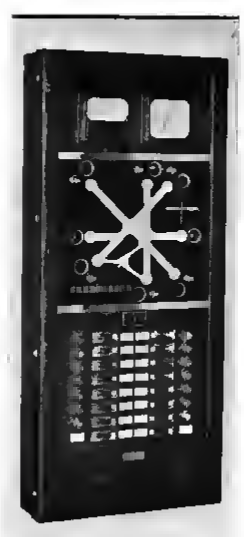
Used in drop hammer work, offered by Cerro de Pasco Corp.

CERROMATRIX AND ITS COMPANION ALLOYS CERROBASE AND CERROBEND products of the Cerro de Pasco Copper Corp, (44 Wall St, New York) have been extensively used for special purposes in connection with dies of all types. A new application is the use of these alloys directly for short run forming dies such as are widely used in the drop hammer process forming of sheet metals in American aircraft plants Normally the die is made of Cerromatrix and the punch of Cerro matrix Cerrobend or Cerrobase For recent die work done by Fleetwings Incorporated, in connection with stainless steel sheet forming, Cerromatrix was used for the die and Cerrobase for the punch. The low pouring temperature, hardness, high resistance to compression and non-shrinking properties make these alloys ideal for such work. —AVIATION, *July 1937*

Field Light Panel—

by Westinghouse simplifies control tower problems

EFFICIENT CONTROL of airport lighting installations is made easy by a graphic new control panel developed by the Westinghouse Electric and Manufacturing Company, and first installed at Greensboro, N C Chief purpose of the new panel is to provide the operator with correct wind direction and velocity in connection with control of the flood-lighting system This is accomplished by mounting instruments in the upper section of the panel to show wind velocity and direction, these instruments being operated electrically from suitably located anemometer and wind vane The center section of the panel contains a miniature colored plan of the field runway system A switch at each end of each runway provides for remote control of the proper group of floodlights for that particular direction of landing Other airport lighting circuit controls are grouped on the lower portion of the panel —AVIATION, *July, 1937*



Airport Control Panel at Greensboro N C.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 23: What solution have you found for smoothing out week-end and holiday peaks in the use of equipment? Do you maintain enough airplanes for slow day requirements and rent equipment from other operators when needed, or do you find it more profitable to have ships idle during the week?

Classify Equipment

OUR MOST EFFECTIVE SOLUTION to the week-end and holiday "peak" problem has been in the classification of ships and operations. We engage in a general charter service and complete course student instruction and operate six airplanes. While of course the charter phase of our business is not predictable, we have a Stinson and a Fairchild for general charters and a Travelair 6,000 ambulance ship that can be converted for passenger service. These ships are also available at peak periods for passenger business. A Stearman is completely equipped for blind flying and a Kinner and Ryan STA are used for student instruction until the pupil is ready for work in the larger ships. By carrying out instruction work and blind flying training through the week wherever possible, we have found that all the equipment pays its way and is also available during week end and holiday "peaks" eliminating the necessity for buying additional equipment.—JOE LEWIS, *President, Lewis Air Service Union Air Terminal Burbank Cal.*

Dates Two Weeks Ahead

Back in the early days of our flying school operating experience we had many a headache about this business of appointments. Equipment jams can be very expensive to a flying school and we set about finding ways and means of remedying the difficulty. It has been so long since we have had any appointment trouble that we think we have the problem completely licked.

In our present system appointments for flight training in the several airplanes are made as far ahead as two weeks in advance, on sheets designed specially for the purpose. In principle we allow 45 minutes for each 30 minute scheduled flight and 1½ hours for each 1 hour scheduled flight. This extra time takes up any delays in take-off or in running overtime in the air or on the ground. Unused time on the ground is used in preparation for flight and for verbal instruction before or after flight lessons. If an appointment cannot be kept the school calls the student immediately to prevent him from coming out to the field to be disappointed.—JOE PLOSSER, *President, Grand Central Flying School, Grand Central Airport, Glendale, Cal.*

Low Week Day Rate

DURING PEAK LOAD CONDITIONS we have tried to offer more inducements to students during week days such as lower ship charges than on Sunday. We believe that a two rate charge is a very satisfactory way of smoothing out the load as there are always a lot of students who want to fly and who will fly and who want lowest rates. These students could be handled on week days to their satisfaction by giving them a lower week day price. This would tend to cut down the Sunday load.—L. G. MASON, *President, Montgomery School of Aeronautics, Montgomery, Ala.*

QUESTION 24: What methods do you use to give your students cross-country flying experience and at the same time make their flying attractive to them? Do you stage air meets, group flights, etc.? If so, how often and how far from the home port do you go? How do you guard against mishaps in these flights and contests? Have you found such activities worth while?

Students Fly on Charters

WE HAVE HAD MOST GRATIFYING RESULTS from giving students cross country flying experience on regular charter trips. In other words, on a good majority of our charters, one-half of the trip will be made without passengers and a student taken along can pilot the ship on that portion of the trip. In this way we have been able to concentrate on point-to-point navigation instruction on long trips with attention to the individual student's shortcomings. This method of training also gives the student experience in all types of ships we are now using and have used in the past for general charters. After flights of this nature a student may be assigned a smaller ship and sent on a solo cross country problem with reasonable assurance that the experience will bring him through. This practice also gives the student experience on longer trips and in more varied weather conditions than any other means we have ever employed.—JOE LEWIS, *President, Lewis Air Service Union Air Terminal, Burbank, Cal.*

Daylight Patrol

WE FEEL that the cross country experience can very easily be attained by sending out an early patrol Sunday morning, flying under secret orders to a given point. Either individual ships or groups of three can go out together and after leaving field they open their orders and find where and when they are supposed to be at a certain airport. All ships then gather at the objective point and have a bull session and then return in time for lunch.

These flights have always been kept to a radius of 50 miles. We have run them at times every two weeks but it takes quite a few owners to cooperate to have a good time. It all depends on how many private and company ships you have at your field whether or not this plan will work out. In general it takes about 6 to 10 entrants every other week to make it go over big.—L. G. MASON, *President, Montgomery School of Aeronautics, Montgomery, Ala.*

Next Month's Question

QUESTION 25: What methods have you used to develop group flying instruction for your school? Have you offered special rates to clubs, fraternal organizations, educational institutions or similar organizations? Have you found group instruction at reduced rates worth while?

News of the Month

Highlighting recent events in the aviation world

Business Booms

Value of sales up 61 per cent. Factories expand to meet the demand for new planes and equipment

THE 1937 BOOM is continuing to place heavy demands on the aircraft industry. Leighton W. Rogers, president of the Aeronautical Chamber of Commerce, has recorded a 61 per cent gain in the value of sales of aircraft, aircraft engines, and spare parts for the first four months of 1937 over the same period last year. The 1937 figures total $30,474,871, against $18,878,805 for the same period in 1936.

Seventh B-17—The Army Air Corps has accepted the seventh of its contracted thirteen Boeing B-17 four-engined bombers. By early June the eighth and ninth were completed and awaiting delivery. No. 7 was flown from Seattle by Lieut. Col. Robert Olds, in command of the Second Bombardment Group at Langley Field. Co-pilot was Maj. Barney M. Giles.

Giant Press—For blanking and forming duralumin aircraft parts the Farrel-Birmingham Co., of Ansonia, Conn., have installed in the plant of the Chance Vought Aircraft Division of United Aircraft a 500-ton hydraulic press. It will deliver a pressure of 2,250 lb./sq.in. on a 24 in. diameter ram.

Order Backlog—Lycoming Division of The Aviation Manufacturing Corp. has announced that unfilled orders on hand for Lycoming engines and Lycoming controllable propellers amount to over $600,000. About half of these orders are for the U. S. Army and Navy, and the rest for private concerns.

Cub Gains—Taylor Aircraft Co., Bradford, Pa., has reported that sales of the Cub for the first three months of this year were up 176 per cent over the same period last year.

Canadian Links—Arrangements for the manufacture of Link Trainers at Gananoque, Canada, have been completed, according to announcement by E. A. Link, president of Link Aviation Devices, Inc. The new factory, with a floor area of 30,000 sq. ft., will produce Trainers for export to England and other countries. R. Watham, vice president of the J. V. W. Corp., exclusive Link sales agent, has just negotiated a substantial contract for the Trainers with the British Air Ministry.

Propellers—Maynard-di Cesare Propeller Corp. is opening a new factory and service shop at the Milwaukee County Airport on July 1. Their constant speed and adjustable pitch propellers will be ready for delivery after July 15.

Goodrich for Douglas—Tires for the Douglas DC-4, 40 passenger, four-engined transport nearing completion in the Santa Monica shops of Douglas Aircraft, are being designed by the B. F. Goodrich Co. Five feet five inches in diameter, the tires will weigh 360 lb. each, will contain 45 miles of tire cord and four miles of bead wire.

Ignition Equipment—To manufacture slow speed high torque fractional hp. electric motors and ignition systems designed particularly for efficiency with low-grade fuels, B. J. Grigsby, president of the former Grigsby-Grunow Co., has organized the Elsbert Manufacturing Co., with a plant at 353 West Grand Ave., Chicago. H. E. Kranz is chief engineer.

More Ethyl—The Ethyl-Dow Chemical Co., which extracts bromine from sea water for use in the production of Ethyl fluid for gasoline, is engaged in a $1,000,000 expansion program at its Kure Beach, N. C., plant. Capacity will be doubled, stepping up production of ethylene dibromide to 20,000,000 lb. yearly.

Ex-Cell-O Agent—Williams and Wilson Ltd., 544 Inspector St., Montreal, Canada, have been appointed manufacturer's representative in that territory for the Ex-Cell-O Corporation.

Exhausting Work—Solar Aircraft Company, San Diego manufacturer of special exhaust manifolds and other special sheet metal parts, reports receipt of the largest manifold order in its history from the Douglas Aircraft Company, Santa Monica. The San Diego plant now supplies exhaust manifolds to a large portion of the U. S. aviation industry, as well as making substantial foreign shipments. With manufacturing operations at a record level the Solar plant has recently been approximately doubled in size.

No. 100 IN A FAMOUS LINE

This Lockheed Electra, hundredth of that model to come from the shops of Lockheed at Burbank, Cal., is destined for service with the Polish airline LOT.

CAVALIER FLIES

to New York from Bermuda, bringing the islands within five and a half hours of the metropolis. Commander William Neville Cumming chats with First Officer Neil Richardson (right) as Radio Engineer Patrick Chapman looks on.

Mead Predicts—

1,800 hp. engines soon, service fuel consumptions of .40 lb.

SOME INTERESTING CONCLUSIONS on the trend in aircraft powerplants were presented before the Royal Aeronautical Society in London April 22 by George J. Mead, vice-president and chief engineer of United Aircraft Corp. The paper was later read before the summer meeting of the S.A.E. at White Sulphur Springs.

Said Mr. Mead in summing up: "The general trend in engine development continues steadily toward ever increasing outputs per liter, with the consequent effect of improving the take-off powers and reducing the engine size in the geometric sense. The development of the present standard types definitely tends toward smaller cylinders for the higher outputs.

"This, combined with the general acceptance of the two-row type for the higher powers, has effected a decided reduction in frontal area per horsepower.

"From the standpoint of performance, take-off powers of 1,500 to 1,800 hp. seem feasible in the period immediately ahead. The ever increasing importance of operating costs has concentrated attention on this most vital performance characteristic. As a result, great strides have been made in reducing the specific fuel consumption, and there is evidence that service consumptions of .40 lb./bhp./hr. may be achieved within the next few years.

"The evident future needs for engines of from 2,000 to 3,000 hp. has focused attention on other types in which additional displacement may be provided through the employment of a greater number of cylinders. Two new engine types may result, namely, the cylindrical or multi-row radial and the rectangular or flat multi-bank in-line.

"Continued improvement in engine cooling has reduced the drag of both the air- and liquid-cooled systems and there appear to be still further opportunities of betterment. The combined reductions of power plant drag may well result in cutting the fuel bill by as much as 10 per cent, which, combined with a possible further improvement in specific consumption gives hope of a net saving of 15 to 20 per cent."

Men Needed—

So schools add courses and instructors to turn them out

THE INDUSTRY'S DEMAND for men is being felt more and more in the country's air schools. The need is for technical training—in engineering, in operations, in design. These needs are being met by the schools through addition of new courses and capable, experienced men to run them.

Newest addition to the staff of the Boeing School of Aeronautics is Edmund L. Ryder, B.S., M.S., formerly Instructor of Aeronautical Engineering at the University of Washington. July 1 he will take over his new duties as head of engineering instruction for the Air Transport Engineering and Practical Aeronautical Engineering courses. His aeronautical experience dates back to 1928, when he was assistant project engineer and designer for the Boeing Airplane Company.

The recently established Dispatching and Meteorology Course at Boeing is quickly proving its worth. 75 per cent of the first class enrolled have already been placed.

Marion McKeen, race pilot and aviation school operator at Clover Field, Santa Monica, Cal., reports business booming since installation of blind flying courses. Among students signed for blind flight instruction are Jack Kirkland, Monte Schoedsack, Stranleigh Tuttle, and a number of other prominent Hollywood personalities. In addition to instructing Hollywood writers and directors McKeen is finding numerous opportunities to do special flying for the aerial pictures which are now so popular.

Parks Air College, East St. Louis, Ill., has added to its staff as instructor

in Air Traffic Control, Air Transportation and Navigation, H L Kirby, who has spent 19 years studying airline operations He has acted previously in a consulting capacity, developing the operational procedure for TWA United, and Northwest Airlines

E W Wiggins Airways, Boston Metropolitan Airport, Canton, Mass, report increased student activity under the direction of Joseph Garside, manager Seventy-two students are now active, six having soloed during the past month. Taylor Cubs and Stinson planes are used for instruction purposes

Big Army Contracts—

Douglas to supply 177 bombers, North American 95 basic combats

THE LARGEST AIRPLANE CONTRACT, in money value, ever placed by the government in peace-time was announced June 10. It was awarded to the Douglas Aircraft Co. at Santa Monica, and called for 177 twin-engined bombers, at a price of $11,651,948. The planes will be Wright Cyclone-powered, and will attain a top speed of more than 225 m p h

To North American Aviation June 2 went an Air Corps contract for 85 "basic combat" planes with spare parts equivalent to ten more Contract price is $1,372 255 The contract was the result of a Wright Field bid opening of March 26 in which North American was low bidder

The basic combat ships, a new type development for the Air Corps, will be powered with 550 hp. Pratt & Whitney Wasp Jr. engines and Hamilton Standard controllable propellers. They will have a high speed of 190 mph This latest order brings the number of planes on order with North American to 454 a few of which, on older contracts, have been delivered.

Calendar

June 28-July 10—Eighth Annual Scoring Meet (International), Elmira, N Y
July 4-9—International Glider Competition, Aero Club of Germany Wasserkuppe.
July 25-Aug 1—Fourth International Aviation Meeting, Zurich, Switzerland
Sept 3-6—National Air Races Cleveland, Ohio.
Oct 7-9—SAE National Aircraft Production Meeting Los Angeles, Cal.

Records to Italy—

Eight new marks set in speed-with-load and altitude categories

EIGHT NEW world or international speed and altitude records were claimed by Italy within the first eight days of May Most important was a new world altitude record of 51,348 ft, attained by Lieut. Col. Mario Pezzi, Chief of the Italian High Altitude School, at Guidonia. The plane was a Caproni 161 open-cockpit biplane, the engine a Piaggio P XI RC 72 two-row fourteen cylinder radial The record beat the 49 944 ft. height reached by Squadron Leader F. R. D. Swain in the British Bristol 138 Monoplane

May 6 a Macchi M.C. 94 twelve-passenger monoplane amphibian, powered with two 750 hp Wright Cyclones, averaged 158 mph over a 621 mi triangular course, and 154 mph. over 1,243 mi, without payload. The machine was piloted by Giuseppe Burei, with Enrico Rossaldi as co-pilot. Two days later the same plane and crew flew over a 621 mi. course, carrying a 5,000 kilogram payload, at an average speed of 159.6 mph, thereby establishing records for 1,102 lb and 2,205 lb payload categories and breaking its own 621 mi record without payload.

Earlier in the month a Cant Z.508 three-engined seaplane set up speed marks over 621 and 1,243 mi triangular courses carrying a payload of 11,020 lb The ship was piloted by Capt. Mario Stoppani, chief test pilot of Cantieri Riuniti dell'Adriatico Speed over the shorter course was 156 mph, over the longer, 154 mph.

New Company Formed

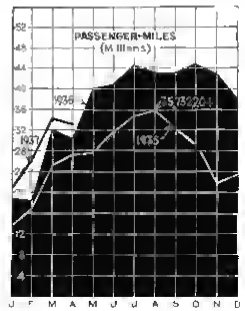
for Taylorcraft production. W. C. Young executive head

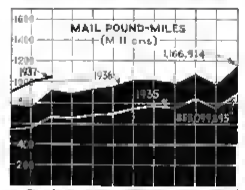
TAYLORCRAFT AVIATION CO, of Alliance, Ohio, has been reorganized as the Taylor-Young Airplane Co, with William C Young, formerly general manager of the Goodyear-Zeppelin Co, as executive vice-president. C G Taylor, designer of the original Taylor Cub, manufactured by the Taylor Aircraft Co of Bradford, Pa, is president of the new company, with Frank L Sullivan as treasurer and Stanley I Vaughn as factory manager

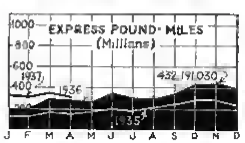
A registration statement covering 290 000 shares of $1 par common stock is to be filed with the Securities and Exchange Commission Of these 115 000 shares will be underwritten by

Traffic

Latest available from the Bureau of Air Commerce & Post Office Department—Domestic air tr







AIR TRANSPORT INDICATOR

May 1, 1937

103.8

—which is the ratio of revenue passenger miles for May 1937 as compared with the corresponding figure for May 1936.

For April 1937 the indicator stood at 105.5

Hiltz & Co., and offered publicly at $3 a share.

Seventeen planes were produced in April, and the May schedule called for 40. As of April 29, the company had on hand unfilled orders for 257 of its light airplanes. The planes are priced under $1,500, and seat two side by side.

Rankin Wins—

Aerobatic contest at St. Louis. New speed mark for Thaden.

ONE OF THE BEST PERFORMANCES at the International Aerobatic Competition and St. Louis Air Races, held at St Louis May 29, 30, and 31, was the capture of the aerobatic competition by Tex Rankin. He flew against a field of considerably higher-powered planes—some specially designed for stunting— and won with his stock 125 hp Menasco-powered Ryan S-T-A. His total was 282 points, with first prize money of $2,000.

The three day meet drew more than 80,000 spectators. It was held in commemoration of the tenth anniversary of Lindbergh's flight to Paris—a flight that was largely backed by St Louis men and money.

A new world mark for women pilots was set up by Mrs. Louise Thaden on the meet's first day. Flying a Beechcraft, the 1936 Bendix Race winner tore over a 100 kilometer (62 mi.) course at an average speed of 197.9 m.p.h., to better by nearly 24 m.p.h. the mark previously set by Amelia Earhart.

"Most outstanding pilot of the meet" was the description voted Roger Don Rae by the judges' committee. He won the title for a skillful forced landing made when his Menasco powered Folkerts went out of control in the eighth lap of a 50 mi. free-for-all in the 397 cubic class. Till then he had averaged 252.8 m.p.h. His forced landing cost him only minor injuries, but washed out his ship.

Soarers Get Ready—

To compete for trophies and $6,000 in cash at 8th national contest

THE EIGHTH ANNUAL NATIONAL SOARING CONTEST, scheduled for June 26 to July 10 at the Harris Hill site at Elmira, N. Y., will offer the inducement of $6,000 in cash prizes and several trophies to competing pilots. Early indications point to a new record in the number of contestants and ships participating. As of June 1, 45 pilots and 31 ships were entered. By opening date, according to a prediction of Dr. Karl O. Lange, meet director, 125 pilots and 50 gliders will be on hand. This would compare with the 82 pilots and 23 gliders at last year's meet.

Three foreign pilots are entered in this first international contest. They are Peter Riedel, of Germany, and Jonas Pyragius and Lieut. Bronius Oskinis of Lithuania.

A prize in a category new this year has been offered by Mrs. Warren E. Eaton. She has placed at the disposal of the Soaring Society the sum of $1,800, which will be awarded for the design and construction of new gliders and sailplanes. First prize will be $1,000.

Felix duPont will offer $500 for the best altitude performance, with another $500 if the American record is broken. Vincent Bendix offers $500 for the longest distance flight, the prize to be raised to $1,000 for a new American record.

Airlines Expand—

TWA gets new planes. UAL stops at Denver. AA will spend $150,000

BOOSTING SPEEDS by taking advantage of the longer range made possible with today's equipment has put the airlines in a strong position for capturing an even larger share of travellers than last year's 1,000,000. Preparing for summer's rush of business, new planes are going into service, new luxury inducements are being offered on the country's systems.

Last in the race for new and better equipment precipitated when Douglas introduced the now-nearly-standard DC-3 and DST models of its famed transport line, TWA went into service on June 1 with its own version of this latest model. Put first on the transcontinental Sky Chief schedules, the new ships will carry TWA passengers coast to coast in fifteen hours eastbound, seventeen westbound, with only three stops.

The Skysleepers, as TWA calls its new ships, are licensed for 25 passengers, carry only 17. Eight will ride in berths, and the other nine in specially-designed chairs costing $500.

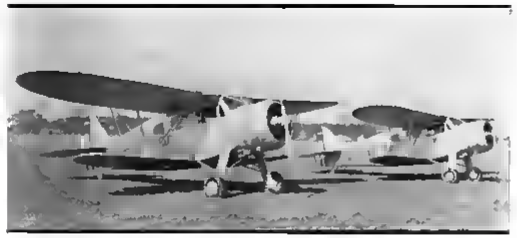
G-100 Cyclones, developed by Wright in conjunction with TWA engineers specifically as "heavy-duty transport engines," will provide the total of 2,440 hp., of which 55 per cent will be used for cruising operation.

New York-Montreal—Operating under a contract with Canadian-Colonial Airways, American Airlines May 15 inaugurated daily non-stop service between Newark and Montreal, using 21-passenger Douglas Flagships. The flight will take one hour and 55 minutes.

American's research program will cost $150,000 in 1937, according to Chief Engineer William Littlewood. A tri-motored Stinson and a Douglas DC-2 will be turned into flying laboratories for experimental purposes.

Denver Wins Out—After ten years of effort, Denver has won itself a place of the transcontinental airway map. United Air Lines has instituted daily service, flying the Chicago-Denver leg non-stop.

Lost & Found—The Western Air Express plane which disappeared last



TWO OUT OF THREE

of the Waco's recently delivered from the factory at Troy, Ohio, to the Coast Guard for border patrol and Internal Revenue policing.

Dec 15 while en route from Los Angeles to Salt Lake with seven people aboard was found June 6. It lay buried in deep snow at the base of a cliff in the Wasatch Mountains 25 miles south east of Salt Lake. Thirty-five miles east of its course, it had apparently struck the face of the ridge full-out.

Dealers Are Active —

The drive to profit by a rising market brings new selling ideas

DALE HUNTER, Porterfield distributor at Sacramento, Cal., has devised a novel merchandising plan. In cooperation with a local automobile dealer a Porterfield Zephyr was put in a prominent place in the dealer's showroom window, and placarded to show low first cost and low operating cost of flying. Hunter reports that many worthwhile prospects resulted.

J. Kirk Baldwin, Wyoming State treasurer, is president of the newly organized Cheyenne Flying Service, Inc. Phil Bradshaw is vice president, and Virgil Fortin secretary. The company has acquired Wyoming distributorship for the Taylor Cub, one of which has recently been delivered. Also included in the flying equipment is a Custom Cabin Waco and an open cockpit Travelaire. The company has been awarded the weather bureau contract for making observation flights from Cheyenne.

Taylor Cub dealer in the West Haven, Conn., district, is the newly organized Frost Air Service.

Inter City Airlines, Boston Municipal Airport, are urging use of daylight saving time to get in more flying evenings.

PORTERFIELD & PONTIAC

Team up in Sacramento. Dale Hunter, Porterfield distributor, instructs the public about the low cost of flying.

New Lockheed High—

$1,000,000 sales recorded in year's first three months

EARLY IN JUNE Lockheed Aircraft Corporation finished the job of moving into its new million dollar administration and factory buildings. Deliveries for the first three months of 1937 hit a new high at approximately $1,000,000 according to Robert E. Gross, president. Deliveries during 1937 to April 20 included fifteen Electras and ten model 12s. Production is now in full swing on the new model 14 with deliveries scheduled to start shortly after the first of July. Eight of the model 14s are for Northwest Airlines, which will style them the "Sky Zephyrs." Lockheed recently completed and delivered the one hundredth Electra transport, believed to be the second time in the history of the aviation industry that any factory has turned out one hundred twin engined transport planes of a single model.

North Pole Reached —

Four Soviet planes set up station there for air route research

AS PART OF A PROJECT to chart Arctic weather and flying conditions preparatory to the establishment of a Moscow U. S. air route over the polar regions, four Soviet planes flew to the North Pole late in May. The first one, carrying Professor Otto J. Schmidt, head of the Northern Sea Route, and piloted by M. V. Vodopyanov, landed May 22 after a 558 mi. flight from Rudolf Island in the Arctic Sea, the operating base for the expedition.

These men with Pilots Babushkin and Spirin and Mechanic Basseni, set up tents and radio sending and receiving apparatus. By May 27 three more planes had made the flight, carrying in eight tons of supplies for the permanent weather station. And by June 6, all four planes had left the pole again leaving it to four men who will spend a year there making observations of weather, floe conditions, water conditions. They will live in tents, derive power for their radio from a windmill-driven generator, subsist on concentrated foods.

P&W's Twin Hornet—

Will power the Douglas DC-4; it develops 1,400 hp. on 95 octanes.

THIRD AND MOST POWERFUL of a series of twin-row engines, the new Twin Hornet developed by Pratt & Whitney will power the prototype of the Douglas DC-4, now being built to the specifications of the five major airlines. The Twin Hornet is a 14-cylinder radial having a displacement of 2,180 cu in. Take-off rating is 1,400 hp at 2,500 r.p.m. using 95 octane fuel and 1,200 hp with 87 octane. Normal rating with 95 octane fuel is 1,150 hp. at 2,350 r.p.m.

The Twin Hornets predecessors, the 825 hp Twin Wasp Jr. and the 1,000 hp Twin Wasp, were introduced in 1931 have since met with wide acceptance.

Russia Buys—

Seversky amphibian license. Company prepares for exports

LICENSE for the Russian manufacture of the Seversky amphibian (Sev-2PA) has recently been granted in a contract with the Amtorg Trading Corp., according to an announcement

by Alexander P. de Seversky. The contract provides for the purchase of two planes and manufacturing rights, for $370,000, and an option for two more together with complete tooling adequate for the production of ten planes a day, for another $410,000. Also provided is a working agreement covering a three-year period, during which Seversky Aircraft Corp. will assist the Russian government in the manufacture of the planes in Russia on a large scale.

To take care of further export orders on the recently-released 2PA, Seversky will set aside a complete building at its Farmingdale, N. Y., plant, so that export manufacture will not interfere with fulfillment of domestic orders. An export demonstrator will soon be sent on a foreign tour.

Taylor to Lock Haven

FINAL SELECTION of a factory site has been announced by the Taylor Aircraft Company. The company's plant at Bradford, Pa., was leveled by fire last March and since then production has gone forward in temporary quarters. The new factory will be located in Lock Haven, Pa., where a factory building has just been purchased. Individual departments started moving the middle of June, without interrupting production, and the entire transfer is to be effected by July 1.

Production facilities will be doubled, the new factory providing 100,000 sq. ft. of floor space. Value of improvements in production facilities, exclusive of the new building, totals $250,000.

Bermuda Service Starts

TRAIL-BLAZING New York-Bermuda flights by Pan American Airways and Imperial Airways began late in May. After six round-trips by Pan American and three by Imperial, in which no difficulties were encountered to hinder regular service, the first passenger flight from Bermuda was scheduled for June 16, the first from New York two days later. For this run PAA will use a Hornet-powered Sikorsky S-42B flying boat, and Imperial Airways will use one of their Pegasus powered Short Empire flying boats. The Sikorsky will carry 24 or 28 passengers, the Empire boat 16. Each will make one round trip a week, providing alternate cooperative service. New York base will be at Port Washington, on Long Island, for the present.

Expansion in Security

SECURITY AIRCRAFT CORPORATION, Long Beach, Cal., has recently started construction of a new factory building measuring 50 by 200 ft. which will provide, with a mezzanine floor, an additional 60,000 sq. ft. of factory space.

THE "DUKE" STEPS OUT

Here J. D. "Duke" Iernigin, Jr., Aviation Manager of The Texas Company, looks pleased as Punch over his new 450 hp. Wasp Junior-powered Stinson Reliant. It's the first of the new Reliants with that power plant.

Anti-Static Device —

UAL develops system for static discharge through a trailing wire

REDUCING RAIN- AND SNOW STATIC by means of a trailing discharge wire was announced June 22 by H. M. Hucke, in charge of United Air Lines Flying Laboratory. A fine wire is suspended 50 feet behind the plane at the end of a larger wire. Between the two wires is a suppressor resistor. Static picked up by the plane tends to leak off via the fine wire, which is far enough from the plane to reduce the effect of the discharge on reception. The suppressor resistor prevents the discharge from reentering via the supporting wire.

P. O. Seeks New Routes

EXPANSION OF THE AIR MAIL MAP is indicated by four advertisements for mail contract bids sent out by the Post Office Department June 9. Most important of the four new routes will be one from Winslow, Ariz., to San Francisco, by way of Las Vegas, Nev., and Fresno, Cal. The ICC recently denied TWA permission to institute service on this route on the ground that it would be competitive with another airline (UAL), though it was admitted that such a service would be in the public interest. Presumably TWA will bid for the mail contract.

Other proposed routes are Washington-Buffalo via Baltimore and Harrisburg; Dayton-Chicago via Fort Wayne, Ind., and Huron, S. D.-Cheyenne, Wyo., via Pierre and Rapid City, S. D.

Navy Buys Ten More S-43s

FOLLOWING UP AN INITIAL ORDER let some time ago for three Sikorsky S-43 amphibians the Navy announced late in May that a contract had been let for ten more of the Hornet-powered ships at a price of $1,960,790. They will be used for service with the fleet.

Cessnas Like Hotcakes

SALE OF SIX CESSNA PLANES in one lot to Mal Carberry, Clover Field, Santa Monica, is reported by Dwane L. Wallace, president of the Cessna Aircraft Company. Carberry, who is Southern California Cessna distributor, has already taken delivery on five Cessnas since the first of the year.

Coast Guard Wacos

THREE NEW WACO five-place cabin airplanes have recently been delivered to the U. S. Coast Guard—one to the Coast Guard Air Station at Cape May, N. J., and the other two to the Air Patrol Detachment at El Paso, Tex. The one to Cape May is equipped with skis in addition to conventional wheel landing gear. All have been corrosion treated and prepared for use on Edo pontoons.

Canadian Burnelli Shipped

CANADIAN CAR & FOUNDRY, Canadian licensee for the Burnelli lifting fuselage transport, was scheduled about the middle of June to ship their first ship to England for Air Ministry evaluation. The Canadian version is powered with Pratt & Whitney Hornet engines. The ship will be available for British Empire markets.

Ryan Output Climbs

RYAN PRODUCTION is being steadily increased, according to T. Claude Ryan, president of the Ryan Aeronautical Company. During the first three months of 1937 production totalled eleven planes.

Pan American's *Bermuda Clipper* (Sikorsky) ... fitted with four Hamilton Standard Controllable Pitch Propellers.

Hands Across the Sea

The attention of the aeronautical world is focused on the Bermuda schedules so brilliantly inaugurated by Pan American Airways and Imperial Airways, as the first step in their joint North Atlantic operations. The world-wide use of the Hamilton Standard type of controllable pitch propeller is emphasized by the fact that both the American and British operators have selected propellers of this type exclusively for these exacting services

HAMILTON STANDARD PROPELLERS

EAST HARTFORD, CONNECTICUT

Division of United Aircraft Corporation

Imperial's *Cavalier* (Short Brothers) fitted with four Controllable Pitch Propellers built by DeHavilland in England under Hamilton Standard license

Deliveries

AVIATION'S report of commercial airplane deliveries for the month ended June 1, 1937.

Purchaser and Number of Units	Type of Buyer	Manufacturer	Model	Engine Make and Model
Aircraft Associates (2)	Fixed Base.	Taylor	J2	Cont. A-40-4
Aircraft Associates	Fixed Base.	Rearwin.	8500	Le Blond 5 F
Aircraft Industries, Inc	Fixed Base.	Stinson.	SR-9-ED	Lycoming R-680-D6
Aircraft Holdings, Inc	Corporate.	Taylor	J2	Cont. A-40-4
Airways, Inc	Corporate	Taylor	J2	Cont. A-40-4
Aly Ney Kenne E	Private.	Waco	EGC.	Jacobs L-5
Armstrong, J. B.	Private	Taylor	J2	Cont. A-40-4
Barber & Morgan	Private.	Taylor	J2	Cont. A-40-5
Bruce, Ralph	Private	Taylor	J2	Cont. A-40-4
Bennett Aircraft, Inc	Fixed Base.	Waco	ZKS-7	Jacobs L-5
Bennett Aircraft, Inc	Fixed Base.	Waco	YKS-7	Jacobs L-4
Benson & Mackolm	Private	Taylor	J2	Cont. A-40-5
Bishop Flying Service		Taylor-Young	A.	Cont. A-40-4
Booth-Henning, Inc	Fixed Base.	Stinson.	SR-9-ED	Lycoming R-680-D6
Bradlute, Blaine	Private.	Taylor	J2	Cont. A-40-4
Brannon, Marcel E.	Fixed Base.	Taylor	J2	Cont. A-40-4
Brant, Gilbert	Private.	Taylor	J2	Cont. A-40-4
Brantley, N. D.		Taylor-Young	A.	Cont. A-40-4
Brayton Flying Service, Inc	Fixed Base	Stinson	SR-9-B	Lycoming R-680-D6
Brayton Flying Service, Inc	Fixed Base.	Taylor	J2	Cont. A-40-4
Brinckerhoff Flying Service.		Taylor-Young	A.	Cont. A-40-4
Burton, Mode	Fixed Base.	Taylor	J2	Cont. A-40-4
Butterwick, Ross		Taylor-Young	A.	Cont. A-40-4
Camel City Fly. Service (2)	Fixed Base.	Taylor	J2	Cont. A-40-4
Camel City Fly. Service.	School	Rearwin.	9000-L	LeBlond 5F
Centro Nacional De Aviacion	Fixed Base.	Taylor	J2	Cont. A-40-5
Chance Vought Aircraft.	Corporate	Fairchild.	"24" G	Warner S. S.
Chisholm, Dr. A. M.	Private.	Stinson.	SR-9-ED	Wright R-760-E2
Cincinnati Aircraft Service		Taylor-Young	A.	Cont. A-40-4
Cummings, Mrs. Marion E	Private.	Stinson.	SR-9-ED	Wright R760-E2
Dart, J. P.		Taylor-Young	A.	Cont. A-40-4
Dennison Airport Operating Co.		Taylor-Young	A.	Cont. A-40-4
De Ponti Aircraft Sales	Corporate	Taylor	J2	Cont. A-40-4
De Wolfe, George	Private.	Rearwin.	9000-L	LeBlond 5-F
Economy Flying Service	Fixed Base.	Taylor	J2	Cont. A-40-4
Ernst, Malden	Private.	Taylor	J2	Cont. A-40-4
Fain Drilling Company	Corporate	Lockheed.	Electra.	Wasp Jr. SB
Fleet Aircraft, Ltd. E.	Fixed Base.	Waco	YKS-7	Jacobs L-4
Fleetwing Flying Club		Taylor-Young	A.	Cont. A-40-4
Folnde, K.		Taylor-Young	A	Cont. A-40-4
Fox Valley Flying Service		Taylor-Young	A.	Cont. A-40-4
Fritsche, Wm. & Paul		Taylor-Young	A	Cont. A-40-4
Frost Air Service, Inc	Corporate	Taylor	J2	Cont. A-40-5
Frothingham, Louise	Private.	Taylor	J2	Cont. A-40-4
Furlong, H.		Taylor-Young	A.	Cont. A-40-4
Gaffke, Thomas.	Fixed Base.	Taylor	J2	Cont. A-40-4
Gage, Bill		Taylor-Young	A.	Cont. A-40-4
Gasser, David	Fixed Base.	Taylor	J2	Cont. A-40-4
General Airways, Ltd. E	Fixed Base.	Stinson.	SR-9-DM	Wright R-760-E1
Gilded Corporation E.	Private	Rearwin.	9000-L	LeBlond 5 F
Gunsalus, Kenneth.	Fixed Base.	Taylor	J2	Cont. A-40-5
Giovanelli, O.		Taylor-Young	A.	Cont. A-40-4
Godsey-Evans Fly. Service	Fixed Base.	Taylor	J2	Cont. A-40-4
Group Capt. T. E. B. Howe	Govt.	Fairchild	24 G Del	Warner S.S.
Haunt, George E	Private.	Stinson	SR-9-CD	Lycoming R-680-D5
Hanford Air Lines.	Air Line.	Lockheed.	Electra.	Wasp Jr. SB
Hitchcock, Jr., Thos.	Private.	Fairchild	Seaplane 24 G Del	Warner S. S.
Hogan, Donovan	Private.	Taylor	J2	Cont. A-40-4
Henroth, Austen	Private.	Taylor	J2	Cont. A-40-3
Horvath, Paul O	Private.	Stinson.	SR-9-EO	Wright R-760-E2
Hudson Valley Fly. Serv	Fixed Base.	Taylor	J2	Cont. A-40-4
Hulton, C. W.	Private	Fairchild	24 H Del	Ranger-6-390-D3
Inter-City Airlines, Inc	Fixed Base.	Stinson.	SR-9-CD	Lycoming R-680-D5
Irvin, Leslie E	Corporate	Stinson.	SR-9-DD	Wright R-760-E1
Jamestown Airways, Inc	Corporate.	Taylor	J2	Cont. A-40-4
Joyce, Dwight F	Private.	Howard	DGA-8.	Wright R-760-E1
Koester, N. E.		Taylor-Young	A.	Cont. A-40-4
King Aircraft Service Co.		Taylor-Young	A.	Cont. A-40-4
Kirberg, Ralph	Private.	Taylor	J2	Cont. A-40-4
Kirberg, Ralph		Taylor-Young	A	Cont. A-40-4
La Grone, Tex.	Private.	Waco	DGC	Wright R-760-E1
Lehigh Aircraft Company	Fixed Base.	Taylor	J2	Cont. A-40-4
Levy, Dr. J. L.		Taylor-Young	A.	Cont. A-40-4
Lippiatt, H. C	Private.	Waco	YKS-7	Jacobs L-4
Lisk, Harry E	Private	Rearwin.	9000-L	LeBlond 5-F
Luro, Jorge A. E	Private.	Waco	YKS-7	Jacobs L-4
*McAlpin, Malcolm.	Private.	Fairchild	"24" C-8-F	Ranger 6-390-D3
McComb, George	Private.	Taylor	J2	Cont. A-40-4
*Mallory III, L. E.	Private.	Fairchild	"24" G	Warner S.S.
Manitoba Air Service E	Fixed Base.	Stinson.	SR 9 DM	Wright R-760-E1
Marden, W. H.	Corporate	Taylor	J2	Cont. A-40-4
Mathis, Margaret.	Private	Taylor	J2	Cont. A-40-5
Mounts, Philip.	Fixed Base.	Taylor	J2	Cont. A-40-5
Mercury Air Service, Ltd. E	Private.	Howard	DGA 8.	Wright R-760-E2
Mason Aero Corp. (2)	Corporate	Taylor	J2	Cont. A-40-5
McLester, Dr. J. B.		Taylor-Young	A	Cont. A-40-4
Miller, Russell A.		Taylor-Young	A.	Cont. A-40-4
Montgomery School of Aeronautics (2)	Fixed Base.	Taylor	J2	Cont. A-40-4
Moore, Russell.		Taylor-Young	A.	Cont. A-40-4
Morley, Henry	Private.	Taylor	J2	Cont. A-40-4
Mundell, Nelson		Taylor-Young	A.	Cont. A-40-4
National Flying Schools.	Corporate	Taylor	J2	Cont. A-40-4
Nitsch, Ed.		Taylor-Young	A.	Cont. A-40-4
North Suburban Flying Corporation	Corporate.	Taylor	J2	Cont. A-40-4
Orrell, K. W.	Private	Stinson	SR-9-ED	Lycoming R-680-D6
Parkinson, Marion		Taylor-Young	A.	Cont. A-40-4
Parrish, Wilbur	Private.	Taylor	J2	Cont. A-40-4
Pasadena Flying Club		Taylor-Young	A.	Cont. A-40-4
Pee Dee Air Schools		Taylor-Young	A.	Cont. A-40-4
Peoria Aero Sales	Fixed Base.	Taylor	J2	Cont. A-40-4
Phelps, Richard.	Private	Taylor	J2	Cont. A-40-4
Polish Air Lines (2) E	Air Line	Lockheed.	Electra.	Wasp Jr. SB
Robbins Co., H. C.	Corporate	Waco	ZGC	Wright R-760-E2
Scott, Cline E.	Private	Taylor	J2	Cont. A-40-4
Scott, R. J.	Fixed Base	Taylor	J2	Cont. A-40-4
Sell, J. Walter	Private.	Taylor	J2	Cont. A-40-4
Sharp, Harry	Fixed Base	Fairchild	"24" G	Warner S.S.
Smith, F. J.	Private.	Taylor	J2	Cont. A-40-4
Smith Flying Service	Fixed Base.	Stinson.	SR-9-B.	Lycoming R-680-D6
Southern Aviation Sales.		Taylor-Young	A.	Cont. A-40-4
The Southwest Company	Corporate	Stinson.	SR-9-B.	Lycoming R-680-D6
Spangler, Edward	Private	Taylor	J2	Cont. A-40-4
*Spencer, J. C.	Fixed Base.	Fairchild	"24" G	Warner S. S.
Stinson Canadian Sales Co. Ltd.	Fixed Base	Stinson.	SR-9-CD	Lycoming R-680-D6
Stohlman, Mont		Taylor-Young	A.	Cont. A-40-4
Stoner Mfg. Corp	Corporate	Stinson.	SR-9-ED	Lycoming R-680-D6
Straughan, Wilbur	Private.	Taylor	J2	Cont. A-40-5
Sunrise Flying Club, Inc	Corporate	Taylor	J2	Cont. A-40-4
Schreiber & Merrill	Private.	Taylor	J2	Cont. A-40-4
Thomas, Lawrence	Private.	Taylor	J2	Cont. A-40-4
Thompson, Peter G	Private.	Lockheed.	Lockheed 12	Wasp Jr. SB
Tittinger, Geo	Private.	Taylor	J2	Cont. A-40-4
Troy Air Service, Inc	Commercial	Rearwin.	9000-L	LeBlond 5-F
Tufts, A. C.	Fixed Base.	Taylor	J2	Cont. A-40-4
U. S. Coast Guard (3)	Govt.	Fairchild	24 H. Del.	Ranger-6390-D3
United Motor Finance Co. E	Fixed Base.	Taylor	J2	Cont. A-40-5
Uyldert, Siegfried	Fixed Base	Taylor	J2	Cont. A-40-5
Valentine, Fred C	Fixed Base.	Taylor	J2	Cont. A-40-4
Vetter, Ernest, D	Private	Taylor	J2	Cont. A-40-4
Valley Airways, Inc	Corporate	Taylor	J2	Cont. A-40-4
Waco Sales of N. Y. Inc	Corporate	Waco	ZGC.	Jacobs L-5
Waco Sales of N. Y. Inc	Fixed Base.	Waco	YKS-7	Jacobs L-4
Walter, A. J.	Fixed Base.	Taylor	J2	Cont. A-40-5
Waterman, F. L.		Taylor-Young	A.	Cont. A-40-4
Western Airlines		Taylor-Young	A.	Cont. A-40-4
Whitaker, Art (2)	Fixed Base.	Taylor	J2	Cont. A-40-4
Whitman, M. B.	Private	Taylor	J2	Cont. A-40-4
Wickersham, C. A.	Private.	Stinson.	SR-9-ED	Wright R-760-E2
Wien Alaska Airways.	Fixed Base	Stinson.	SR-9-B	Lycoming R-680-D6
Wilson, J. Frank	Fixed Base.	Taylor	J2	Cont. A-40-5
Wilson, Raymond J		Taylor-Young	A.	Cont. A-40-4
WingsField, Inc	Private.	Waco	DGC	Wright R-760-E8
Young, Harry	Private.	Waco	EPF 7	Jacobs L-5

Asterisks (*) indicate previous unreported deliveries made prior to May 10 1937. "E" indicates exports.

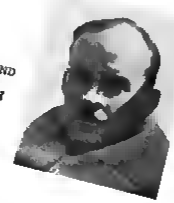
Aviation People

Who's who and what they are doing

RICHARD C. GAZLEY

DR. HUGO ECKENER

THEODORE P. WRIGHT



EDMUND T. ALLEN

» The Bureau of Air Commerce is filling in the gaps in its new set up Most recent appointment is that of Richard C Gazley as chief of the Safety and Planning Division He will supervise the seven sections engaged in development and promotional work. Graduating in aeronautics in 1924, Mr Gazley was appointed research engineer for the N.A.C.A. Shortly after he went with Glenn L Martin Company as staff engineer of structural design, and in 1927 joined the Bureau, serving as aeronautical engineer until 1929 when he went forth on his own as consulting engineer In July, 1930, however, he was back with the Bureau as chief of the engineering section In that capacity he had charge of the preparation of engineering standards covering aircraft, engines propellers and repair stations and the checking of technical data and stress analyses submitted by manufacturers

» Dr. Hugo Eckener was chosen to receive the Daniel Guggenheim Medal for 1937 "for notable contributions to trans-oceanic air transport and to international cooperation in aeronautics." Presentation will be made at a dinner to be given in his honor in New York on Dec 17, the 34th anniversary of the first flight of the Wrights Officers of the Board of Award of the Daniel Guggenheim Medal Fund for 1937 are T P Wright, vice-president of Curtiss-Wright Corporation, succeeding Major E. E. Aldrin as president Sherman M Fairchild vice-president; John H R. Arms, treasurer, Major Lester D Gardner secretary Other board members are Charles H. Chatfield, Glenn L. Martin, Temple N Joyce, Thomas A Morgan, Dr George W. Lewis, Prof Baldwin M Woods, William B Mayo

» The bristling armory that is the 4-engined Boeing XB-15 will have at the controls on its initial hops a slight, mild mannered engineer, but one whose skill as a test pilot assures complete dominance of the formidable bomber Edmund T Allen, consulting engineer and test pilot, has been a flyer for 20 years, and has test-piloted almost every size and variety of plane After wartime service with the Army Signal Corps as instructor, Mr Allen flew the Army mail, became test pilot for the N.A.C.A., then pilot for the Post Office Department Since 1930 he has served as consulting engineer for Douglas, Northrop, Lockheed, Curtiss-Wright, Vought, General Aviation Stearman, TWA Pan American-Grace, and latterly Eastern Air Lines Most significant of his recent work has been development of a scientific basis for cruising control in transport operation, as described in a series of articles (Aviation, 1934-1935) of which he was co-author with W Bailey Oswald.

» Edmund L. Ryder becomes head of engineering instruction for the Air Transport Engineering and Practical Aeronautical Engineering courses at Boeing School of Aeronautics In 1928 Mr Ryder was assistant project engineer and designer for Boeing Airplane Company, joining Seattle Aero motive Corporation as chief engineer in 1930 From there he went with Douglas as assistant project engineer and since 1932 has been associated with the University of Washington, first as research assistant in the aeronautical engineering department and for the past three years as instructor of aeronautical engineering

» Hamilton Standard Propellers Division of United Aircraft Corporation has announced the appointment of A H French as Installation Engineer Mr French has been identified with the organization for the past two years and was formerly associated with General Electric Company and Pan American Grace Airways.

» From Manhattan's sizzling towers to Bermuda's coral strand went Aviation's editor on June 8. Before the staff could get to the anticipated ball game, he was back at his desk,—the very next day in fact it was Pan American's U.S.A. Bermuda Clipper which thus quickly transported him and 25 New York and Washington press men on a perfect demonstration flight, with a swim tossed in Shortly after the first passenger trips Pan American announced the tentative personnel in charge of the Bermuda Service and the Atlantic Survey J Carroll Cone, recently Assistant Director of the Bureau of Air Commerce is Acting Division Manager Atlantic Division; Edward W McVitty Acting Division Engineer; Clarence H Schildhauer, Acting Operations Manager Wilson T Jarboe, Jr. Acting Division Communications Superintendent. The three latter come from within the ranks of Pan American

» Clancey Dayhoff, dean of Pacific Coast airline publicity men, has been promoted to general manager of the TWA news bureau with headquarters in Chicago. Dayhoff will take his assistant, William Wagner, to Chicago with him In Los Angeles a second major shift occurred when Don Black, formerly in charge of Los Angeles publicity for United Air Lines, accepted a position with TWA to fill the position vacated by Dayhoff Arthur LaVoie, Los Angeles newspaperman was named by Harold Crary to take over United publicity for Southern California. He will be assisted by Miss Maxine Finley

» Ragnar T Freng, veteran pilot in the field of instrument-landing, has been named chief of flying for United Air Lines

» In 1922, F. R Shanley, a violin student at the Institute of Musical Art in New York, had hitched his wagon to the concert platform as a career. An urge for engineering deflected his course, and after graduating from Pennsylvania State College as a refrigeration engineer, he found himself in that capacity with the New York Ice Machinery Company A year later, realizing that aeronautics appealed more strongly, Shanley joined the engineering staff of Consolidated Aircraft Corporation where he remained for two years. He then went with the Airworthiness Section of the Certificates & Inspection Division of the Bureau of Air Commerce and with the exception of a year spent with Hall Aluminum Aircraft Company as engineer, was connected with the Bureau from 1930 until his present post, again on the engineering staff of Consolidated Aircraft Corporation Mr. Shanley is well-known to Aviation's readers through his frequent contributions on engineering problems the most recent of which—"Stress Ratios," appeared in June, 1937

» Paul Kollsman, president of Kollsman Instrument Company is getting ready to move his plant from Brooklyn to the newly remodeled factory at Elmhurst, Long Island which is expected to be ready for occupancy about August 1st. Mr Kollsman was born in Germany and for several years after coming to this country was engaged in engineering work In 1928 he organized the Kollsman Instrument Company to develop and manufacture precision aircraft instruments, his first success being the Kollsman sensitive altimeter, which made possible the first blind landing in 1929 by Major James Doolittle The company's greatly augmented line of instruments are now made under license in England, Germany, and Japan.

» Winners of the 1937 W. E. Boeing Scholarships were: First award (Airline Pilot and Air Transport Engineering course) to R. Dickson Speas of M.I.T.; second award (Practical Aeronautical Engineering and Amateur Pilot courses) to Robert T Lamson of University of Washington, third award (Airline Operations and Amateur Pilot courses) to William A Wichers of Hope College; fourth award (Airline Mechanic course) to George T Hayes, of Riverside Junior College

» The Chance Vought Airplane Design Prize for 1937 went to Robert Boyer, a senior student at the Daniel Guggenheim School of Aeronautics of New York University, for his design of a single-engined transport plane Upon graduation Mr Boyer will enter the design department of Lockheed Aircraft Corporation

» A meeting of the stockholders of Macwhyte Company resulted in the election of George S. Whyte, formerly president, as chairman of the board of directors. His son, Jessel S Whyte, former vice-president and general manager, succeeds him as president, retaining his general managership

JESSEL S. WHYTE

PAUL KOLLSMAN

» Resigning his position with Viking Flying Boat Company, F. T. Kuat is now associated with Gillies Aviation Corporation as an aviation consultant and in aircraft sales work He has also taken over the presidency of the Country Club Flying Service, operating at the Aviation Country Club of Long Island.

» Two aviation people received the honorary degree of Doctor of Science from Norwich University of Northfield Vt.,—Colonel Edgar S Gorrell, president of the Air Transport Association of America, for "devoting his entire time to formulating a solid business foundation for the air line industry of America" and Willis R Gregg, chief of the United States Weather Bureau, acclaimed as "a distinguished contributor to the advancement of the science of meteorology"

» Murray Hawley, heretofore traffic representative at Eastern Air Lines' New York office, has resigned to become sales manager of North Beach Air Service, where he will be in charge of sales of Howard airplanes

» From Far and Wide Capt Papana of the Rumania Air Force, all the way to Long Island to take a course of training with Aircraft & Radio Instrument Training Co. at Roosevelt Field Major Soderberg of the Swedish Air Force who received a demonstration on instrument flying at the same source and purchased a Link Trainer to be used in Sweden.

E R Desoutter of Desoutter Brothers, Hendon, England, to negotiate for the handling of his firm's pneumatic tools and to spot possible sources at our aircraft factories.

Mihenko Mintrovic chief engineer and Vladimir Strizevski chief pilot of the Jugoslavian airline "Aeroput", Luis de Gonzales of the Columbian Army H. S. Royce production engineer and A. G. Elliott, chief designer of Rolls Royce, England, and J. C. Standring works manager of the propeller section of de Havilland Company, England, all with faces turned towards our aircraft production units.

John H Millar of Millar Aviation Ltd. London, on a commercial mission for his company.

To Far and Wide Amy Mollison, homeward bound and audibly disgruntled at the cancellation of the New York-Paris Race "to protect Pan American Airways." W. W Kellett president and R. N. Parwitt, executive engineer of Kellett Autogiro in Europe to study further autogiro developments

How Many Engines?

(*Continued from page 31*)

period between overhauls which maintains as a greater proportion of the maximum power of an engine is used, and further by the fact that structural failures in the power plant units are much more likely to occur under maximum power conditions. Since the likelihood of a power plant failure on a multi-engine airplane increases with the number of engines, the difficulties which may arise on take-off also increase with the number of engines.

A compensative factor to consider is that, after a power plant failure in take off, a four engine airplane will still have three-fourths of its power while the twin-engine airplane will have but half. However, when the crew coordination is taken into account, the net conclusion is reached that a two man crew can handle a twin-engine airplane operating at take off on half power in a manner equally as satisfactory as a three man crew, a four-engine airplane on three-fourths power. Therefore the two-engine airplane, in which there is half the likelihood of a failure, is the relatively safer airplane.

It should be added, parenthetically, that a power plant failure on take-off does not mean necessarily a crash, generally it means only that the pilot will either stop immediately or take-off and fly around the field and land again, depending on the circumstances but it does mean that, at least for a few moments, the entire attention of the crew will be centered on compensating the controls, etc., to hold the airplane on its course, introducing some "human element" into the situation. Already we can see progress toward the solution of this problem. The further development of the automatic gyroscopic pilot is being carried on at the present time to make these automatic pilots satisfactorily operative in take-off to provide this compensation when necessary.

Thus it becomes a subject of some conjecture as to which is the safer type: the four-engine airplane requiring two engines for flight, or the two-engine airplane requiring one. It is a general concensus of opinion that the two types are essentially equal when operating over land as in the United States, and that either type is very satisfactory from the safety point of view. Therefore, we must consider other factors in order to answer the question: "How many engines?"

Performance, Weight, Economy

The estimated characteristics of three proposed pressure cabin airplanes, all considered to represent the most advanced type suitable for cruising at 20,000 ft. altitude, are given in Table I. The sizes and weights of these airplanes were chosen with an emphasis on greater payload, range, and economy. It should be remarked that it is also possible to design faster airplanes around these same engines if one is willing to sacrifice payload and economy by making the airplanes smaller and lighter. Types "A" and "B" are airplanes of essentially the same size, "A" using two large engines and "B" four smaller ones of the same total horsepower. Type "C" is a larger airplane using four large engines of the type used in "A." The weights and proportions of the three types were made such that all would have equal safety.

The estimate of "Direct Operating Costs" given in Table I, has been made according to the method of Perkins (reference 3) which has been found to give results that are consistent with the costs as observed by airline operators. These direct operating costs consist of the costs of: fuel and oil, salaries to pilots and crews,

Table I—Three Pressure Cabin Airplanes

Type	A	B	C
No. of engines	2	4	4
Take off power per engine (b.hp.)	1,500	750	1,500
Cruising power per engine (b.hp.)	800	400	800
Performance			
Cruising speed at 20,000 ft (m.p.h.)	207	202	209
Take-off distance over 50 ft (ft.)	1,900	2,100	2,100
Landing speed (m.p.h.)	69	70	71
Absolute ceiling on half of engines (ft.)	13,000	10,000	11,000
Weights			
Empty weight (lb.)	23,000	23,900	48,500
Crew	620	790	790
Fuel and oil (1000 mi. flight)*	5,030	5,120	10,020
Payload	4,350	4,190	10,690
Useful load	10,000	10,100	21,500
Gross weight	33,000	34,000	68,000
Percent payload	13.2%	12.3%	15.7%
Percent useful load	30.3%	29.7%	31.6%
Direct Operating Costs			
Per hour	$90.00	$100.00	$170.00
Per mile (block to block)	47.8¢	54.6¢	89.6¢
Per payload unit mile†	2.20¢	2.61¢	1.68¢

* With provision for 1 hr. reserve against 20 m.p.h. headwind
† Payload-unit is 200 lb.

Table II—Engine Characteristics

Engines with Approved Type Certificates

Engine	b.hp	Bare weight lb.	lb./b.hp.	Diam. in.	Nacelle parasite area†	
					f_n sq.ft.	f_n/b.hp.
Lambert R-266	90	222	2.47	34.25	61	0068
LeBlond	110	275	2.50	33.25	61	0055
Super Scarab	145	305	2.10	36.6	73	0050
Kinner R-5-11	160	330	2.06	45.7	96	0060
Continental						
W-670-M1	250	460	1.80	42.5	97	0039
Jacobs L-5M	255	495	1.74	43.5	1.02	0036
Kinner C-7	300	630	2.10	48.28	1.16	0039
Kinner SC-7	370	650	1.76	47.75	1.20	0032
Wasp Jr.	450*	610	1.36	45.75	1.20	0027
Whirlwind R-975E-3	450*	680	1.47	45.0	1.18	0026
Wasp	600*	883	1.47	51.4	1.45	0024
Hornet	800*	1,015	1.27	54.4	1.65	0021
Twin Wasp Jr.	825*	1,070	1.30	44.1	1.46	0018
Twin Wasp	1,000*	1,265	1.27	48.0	1.55	0016
Cyclone G 102	1,100*	1,275	1.16	55.0	1.80	0016
1500 hp. Radial‡	1,500*	1,925	1.28	55.0	1.95	0013

* Take-off rating.
† Nacelle parasite area under cruising conditions with cowl flaps retracted.
‡ Estimated characteristics, No. A-T-C. issued as yet for any engine of this type.

maintenance of airplanes and engines, depreciation of airplanes and engines, and the necessary forms of insurance usually carried by the operators.

Let us look at the results of Table I. Comparing types "A" and "B," we see that the performance of type "A" is appreciably the better, as is

(*Turn to page 67*)

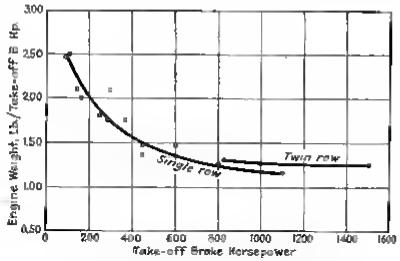


Fig. 1. Bare Engine Weights, Radial Aircooled Engines

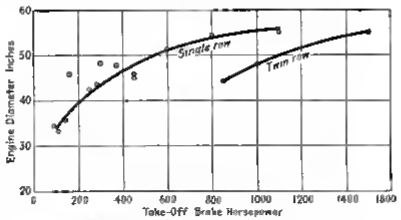


Fig. 3 Diameter, Radial Aircooled Engines

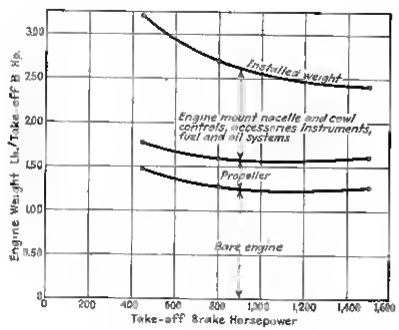


Fig. 2. Installed Weight, Radial Aircooled Engines

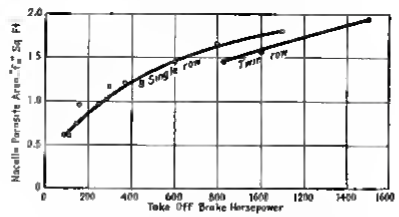


Fig. 4. Nacelle Drag, Radial Aircooled Engines

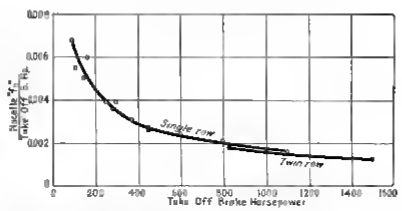
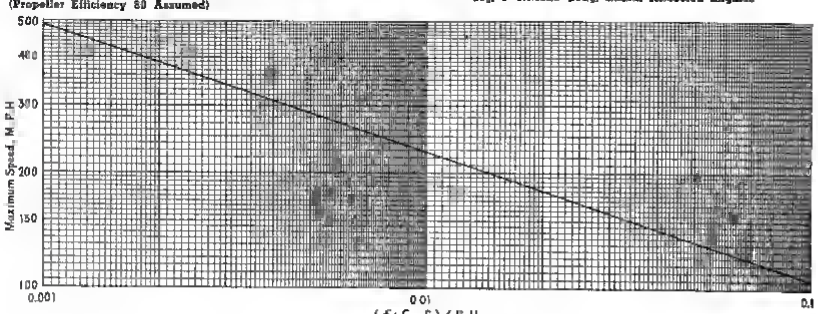


Fig. 5 Nacelle Drag, Radial Aircooled Engines

Fig. 6. Maximum Speed at Sea Level Using Take-Off Power. (Propeller Efficiency 80 Assumed)



How Many Engines?

(*Continued from page 64*)

also the payload, per cent payload, per cent useful load, and all operating costs. Thus Type "A" is superior to "B" on all counts, which indicates that it is better in every way to use two large engines than four smaller ones of the same total horsepower. Comparing types "B" and "C," we see that performance, weights, and operating costs per payload-unit improve for a given airplane type as we go to still larger and larger airplanes at least within the present range of contemplated airplane sizes.

It is interesting to note that, by interpolation between types "B" and "C", we find that a four engine transport must be at least 45,000 lb. in gross weight with 1000 hp engines to have equivalent performance, weight ratios, and cost per payload unit of the two engine airplane of 33,000 lb gross weight. Hence it appears that a four-engine airplane must be about one-third larger than a two-engine design of the same type to have equal efficiency to the two engine.

Can the conclusions drawn from these specific examples be applied to all types and sizes of airplane? To answer this, let us consider some general characteristics of aircraft engines comparing the engines on the basis of the maximum power developed.

Table II and Fig. 1 to 5 have been prepared for representative radial air-cooled engines of the highest power ratings in their respective classes. We have restricted this study to radial air-cooled engines, in order that all the characteristics may be more directly comparable, inasmuch as the specific weights per horsepower of in-line air-cooled engines are essentially the same as those of the equivalent radial engines, and the estimated nacelle drags of the installed power units do not differ appreciably.

From Fig. 1 it is seen that the engine weight per horsepower has decreased with increasing horsepower in the single row and twin row types in the range of powers shown. An observation, of secondary significance in the present considerations, is the weight differential of about 0.1 lb./hp. in favor of the single row type where such are available. It has been found for controllable propellers that the weight per horsepower is generally around 0.3 lb./hp. and does not vary appreciably with the power rating in the range of commercially available propellers.

However, the specific weights per horsepower of many details of a power plant installation do decrease considerably with increasing power, particularly such items as: nacelle structure, engine cowling, engine controls, accessories, instruments and fuel and oil systems. The effects of these items have been estimated for a particular case, assuming a constant amount of fuel and oil capacity per horsepower. The results, plotted in Fig. 2, show that the installation weight is largely responsible for the weight differential in favor of the larger power plant units.

From the above considerations, it can be generalized that *the empty weight of any given size airplane with a given total horsepower will be a maximum when the airplane is designed with the fewest number of the most powerful engines available and suitable.*

In considering the performance, the nacelle drag can be expressed in terms of "parasite area", f, as defined in reference 4 as:

$$\text{Drag} = f\,\frac{\rho V^2}{2} \qquad (1)$$

where

ρ is air density
V is velocity of airplane

For a nacelle of the type commonly used today, mounted on the wing leading edge, the parasite area in cruising with cowl flaps retracted may be expressed by the empirical equation

Nacelle parasite area $f_n = .0163D + .0271\sqrt{b.hp.\ max.}$ (2)

where

D = engine diameter—inches
b.hp = max. engine power

In equation (2) the first term (.0163D) covers the "external drag" of the air flowing over the outside of the nacelle. This relationship is believed to be correct because, although the frontal area varied as D^2, the length of nacelles is usually determined by the balance requirements for the weight of the airplane and by the need to house the retracted landing gear. Since the length increases relatively slightly with the diameter, the external area (and consequently the skin friction) varies only slightly more rapidly than D. Taking into account the fact that greater aerodynamic refinement is practical for larger engines, and that the Reynolds Number increase further reduces the drag coefficients, the conclusion is reached that the external drag of the nacelles varies as D, as shown by the equation.

In equation (2) the second term (.027$\sqrt{\text{b.hp. max.}}$) represents the "internal drag" which includes the cooling drag and other losses in the air passing thru the engine. In this case again, the higher powered engines make practical greater efficiencies in cooling by the use of fighter intercylinder baffles, engine cowl flaps, and closer cowling, so that the exponent of this term becomes the square root in place of the first power which would otherwise maintain.

The variations of engine diameter, nacelle parasite area, and the ratio of f_n/b.hp. are shown in Fig. 3 to 5. Fig. 5 seems particularly significant when it is appreciated that the value of f/b.hp. is .010 to .015 for complete airplanes with maximum speeds at sea level equal to 200 m.p.h. to 230 m.p.h. Therefore, on such airplanes the nacelle drag represents approximately ¼ of the total if 200 hp. engines are used, ⅓ of the total drag if 400 hp. engines are used, ⅛ of the total drag if 800 hp. engines are used, 1/9 of the total drag if 1600 hp. engines are used. If the maximum speed is greater, the effect of nacelle drag is greater; while if the maximum speed is less, the effect of the nacelle drag is less.

Fig. 6 gives the relationship between the ratio $(f+C_mS)$/b.hp. and the maximum speed at sea level which holds true for all airplanes when the propeller efficiency is corrected to .80. Using Fig. 6 in conjunction with Fig. 5, one can estimate the percentage of nacelle drag for any airplane of a certain speed, with wing engines of a certain power. From these data, it is easy to discern another underlying theorem that the *speed of any given size multiengined airplane with a given total horsepower will be greatest when the airplane is designed with the fewest number of the most powerful engines available and suitable.*

The economics of operations are affected by both the weight (payload) and the speed for a given power in such a way that the operating cost, as controlled by both of these factors, will be the least for an airplane of a given size and total horsepower which incorporates the highest powered engines as seen above. The other factors of operating cost are also im-

proved by using high powered engines, particularly the cost of maintenance of the engines, controls, fuel systems, etc, when considered in terms of cost per horsepower developed. Furthermore the fact, as discussed above, that a two man crew can handle any twin engine transport airplane while at least a three man crew is necessary for four engines reflects to the disadvantage of any four engine transport using relatively small engines which could be replaced by two larger engines.

Conclusions

1. *The safety of two engine and four engine transports when operating over land as in the United States is essentially equal*, both types offering great safety when using modern engines which have high reliability. The two engine transport is believed to offer relatively greater security in take-off and the four engine transport greater security in cruising.

2. *For a given size airplane requiring a certain total horsepower, the payload, performance, and operating costs are all the optimum when the airplane is designed to incorporate the fewest number of the most powerful engines available and suitable.*

3. While not substantiated conclusively by the data of this paper, it should be remarked that airplanes can be improved with respect to payload ratios performance, and operating cost per payload-unit by going to greater size and gross weights, at least in the range of sizes of the presently conceived transport airplanes.

4. It was concluded from a specific example that a *four-engine airplane must be at least one-third larger than a two engine airplane of the same type in order to have equal efficiency based on payload ratios, performance, and operating cost per payload unit.*

5. From the above it logically follows that the policy governing the selection of equipment by airline operators in order to obtain the greatest efficiency of operation should be the following:

a. Develop and use multi-engined airplanes of the largest possible size consistent with the amount of traffic to be handled and the frequency of schedule desired.

b. Equip these multi-engined airplanes with the fewest number of the most powerful engines available and suitable to the size of the airplane.

c. Note that with the presently to be available engines, the optimum twin-engine airplanes for payload and economy of operation is believed to be one using 1500 hp. engines having a weight of about 33,000 lb. gross. A four engine transport, to be used on routes where the traffic is sufficient to fill airplanes of all sizes to an equal proportion of their payload, should have a gross weight of about 45,000 lb. to obtain an operating efficiency equal to the above twin-engine transport.

References

1. Wright, T. P. *Relation between Airplane Design and Commercial Uses of Airplanes*—Paper read at Annual Meeting of the American Society of Mechanical Engineers in New York—December 1928.
2. Perkins, Kendall. *The Relative Safety of Multi-Engine Airplanes*. Journal of Aero Sciences, January, 1936.
3. Perkins, Kendall. Dollar Values in Airplane Design. *Journal of Aero Sciences*, February, 1937.
4. Oswald, W. Bailey. *General Formulae and Chart for the Calculation of Airplane Performance*. NACA TR408.

Compasses

(*Continued from page 23*)

In applying the error due to deviation it is important to remember, as with variation, that the compass markings indicate direction by moving relative to a fixed lubber's line representing the head of the aircraft. If the compass card be pulled 10° to the left or west by deviation a plane heading 20° magnetic would show a reading of 30°.

Thus it is seen that easterly deviation should be added to the compass course to obtain the magnetic course, and westerly deviation should be subtracted, or

Deviation east, compass least.
Deviation west, compass best.

Acceleration and Turning Errors

A freely suspended magnetic needle aligns itself with the earth's lines of force, which dip below the horizontal from 0° at the magnetic equator to 90° at the magnetic pole.

Turning Errors—This error was first noted for turns made on North-south courses, and is called the northerly turning error. Actually it is only one case of the general problem. If on a northerly course a plane turns short right and banks normally, the acceleration is to the east and the compass will also be banked with the plane, so that the plane of the needle is tilted. In this position of tilt the compass needle will be acted on by the vertical as well as by the horizontal component of the earth's total magnetic force while at the same time the needle is mechanically restricted to effective motion in the tilted plane. The needle therefore takes a resultant position with its north end to the right or east of the correct compass course, and at an angle below the horizontal less than the total angle of dip.

Acceleration Errors—In turning right from north it is the acceleration to the east which tilts the plane of the needle and causes the easterly deviation. Acceleration on an easterly course sufficient to give this same angle of tilt would cause the same deviation. In other words, turning, slowing, or speeding-up cause accelerations, which in turn tilt the compass.

In turning left from north, or accelerating to the west, we find by the same reasoning, that the needle is deflected to the west, giving a westerly deviation. In the case of northerly accelerations, the plane of the needle is tilted up aft and the needle is more nearly aligned with the earth's lines of force so that the directive force of the needle is made stronger, without causing deviation. For southerly accelerations the needle becomes more nearly perpendicular to the earth's lines of force and loses all or part of the directive force. The same reasoning will make clear the action of the compass on other headings and in other latitudes.

We may therefore make a general rule covering the action of the compass under acceleration, whether this be due to a change of course or speed.

North Latitude

Easterly acceleration causes Easterly deviation; Westerly acceleration causes Westerly deviation.

South Latitude

Easterly acceleration causes Westerly deviation; Westerly acceleration causes Easterly deviation.

These rules are diagrammed in Fig. 1.

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Compasses

(*Continued from page 68*)

Practical Compensation

In compensating compasses for deviations caused by adjacent magnetic materials in the plane itself a few simple rules are useful Stow tools and other magnetic items in normal position then

a Head the plane on magnetic north.

b Place athwartship magnets so as to make the compass read O Whenever the compass reading is being taken the fuselage and controls should be approximately in the position of level flight and the compass should be tapped with the finger.

c Head magnetic east

d Place fore-and-aft magnets so as to make the compass read 90°.

e Head 180° magnetic. If the compass is out more than 2° or 3°, remove half of the remaining deviation by athwartship magnets

f Head 270° magnetic If the compass is out more than 2° or 3°, remove half of the remaining deviation with fore and-aft magnets

g Now head 0° magnetic and note the deviation of the compass Head 45°, 90°, 135°, 180°, 225°, 270°, and 315° magnetic and note the deviation in the same way, and make out a table of the deviation in the same way, and make out a table of the deviation for all headings on which it was noted

h With the table of deviation as made out, plot a curve of magnetic course deviations, then pick off from this curve the deviatioo on each 10° magnetic heading and complete a compass card or course converter for handy reference in the plane

For special cases, and for further details, see Chapter VI, Air Navigation (McGraw-Hill Book Company, New York.)

Other Compasses

While the magnetic compass just described is the only one generally used in aircraft there are several other types, as follows

a Earth Inductor Compass which uses the earth's lines of force as the field of a generator, the variable current from which indicates the direction. It is not in general use For details see Chapter XVI, Air Navigation.

b Sun Compass, consisting of a 24 hour clock tilted to the angle of the latitude, so that the sun's shadow indicates true direction Its principal use is in the polar regions

c Holmes Telecompass which utilizes the variable resistance through the compass liquid to operate repeaters and to overcome inertia. For a description see Air Navigation, British Empire Edition

d. Cathode Ray Compass, which utilizes the electron "gun" and screen to indicate true direction. This device is undergoing development and offers interesting possibilities. It is also described and illustrated in the new British Empire Edition of Air Navigation.

Tooling for Production

(*Continued from page 27*)

engineering, more planning, operation sheets, layout, designing and building of tools All this work is performed by specialized groups that cannot be rapidly expanded for short periods There are also practical limitations to the amount of equipment that may be accumulated and also to the personnel that can be concentrated in a short space of time

There does not seem to be much question but that because of the condition described, it takes longer to get under way, however, several things may be done to lighten peak loads The most fortunate position is to have continuity of business, enabling an organization to retain its trained personnel This alone would cut the elapsed time usually required to get under way about 25 per cent Other aids are advanced bills of material and scheduling in proper sequence of Engineering releases of parts and assemblies which entail the biggest manufacturing problems. A sound long range policy for planning and purchasing equipment on a budget basis is not only helpful but essential Accurate knowledge of equipment capacity for making tools and fabrication of parts help to determine how much subcontracting, if any, should be considered.

A recognition of the personnel problem and particularly supervision will aid materially. Departments of small importance in the past have become the major ones and vice versa, some have been eliminated altogether and new ones have been created. Shifting and training of personnel, if possible, from within the organization is another problem requiring study and good judgment

N.A.C.A. Picnic

(*Continued from page 29*)

physical effect of the acceleration on passengers immediately demands study One-half "g" is not considered excessive for passenger comfort and a catapult producing this acceleration on the above hypothetical airplane with high lift device and constant speed propeller would reduce the take-off distance to 1,150 ft. But to get the necessary thrust from a catapult to launch a plane of specifications similar to the new DC-4 would require 3,250 hp To obtain this from an electric motor would be impractical and too expensive for serious consideration. A heavy flywheel however, could be made to store sufficient energy for the purpose In about 5 minutes using an electric motor of small horsepower and cost

Since seaplanes are being used in long range over water operations, the committee has been seeking improved take-off characteristics in their design Work in the towing tank (which is soon to be lengthened by nearly 1,000 ft.) has indicated that resistance and manner of take-off are important factors Progressive steps on a hull model of proper beam showed original take-off time of 58 sec was reduced to 48

(*Turn to page 72*)

sec. by selecting correct angle of afterbody keel. Reduction to 34 sec. was accomplished by removing rivet heads from the hull bottom. Correcting the trim angle cut the time to 27 sec. This final reduction is made possible by a new instrument developed by the Committee and called the trim angle indicator. Operating on the periscope principle, the indicator is mounted on the seaplane instrument board to assist the pilot in selecting the proper trim angle for take off.

Modern low wing monoplanes with their efficient tapered wings are sometimes inclined to display undesirable characteristics at high angles of attack. To prevent this sudden stall the laboratories have developed the "stall control flap," a product of the variable density wind tunnel and the flight test section. The new flap is of large proportions, full span and 60 per cent of the chord. A series of colored motion pictures showed the action of the flap in flight tests.

Self-reproach was felt by many of the visitors because they had not thought of the simple method found to fick "shimmy" in front wheel landing gears. As a matter of fact the method was derived mathematically by one of the members of the N.A.C.A. staff. It consists merely of allowing a certain amount of lateral freedom for the castering wheel on its axis. Full scale tests have been made on the W-1 airplane and the front wheel shimmy has been entirely eliminated even when passing over large objects.

Cowls that Cool

A highly practical solution of the cooling problem in the N.A.C.A. cowling was shown in finished form. The new cowl is of the two position, nose slot type with one setting for take off and climb and the other for high speed or cruising speed. In the low speed position this cowl produces the greatest pressure differential between the two sides of the cylinder that has been obtained with any of the many types tested by the N.A.C.A. The high speed slot produces the greatest aerodynamic efficiency so far found. Culmination of many years of tests, it definitely settles the question of which parts of the cowl are built by the plane manufacturer and which by the engine maker. In the future this cowling will probably be built as a part of the engine, just as a water jacket is part of a liquid cooled engine.

Six simultaneous conferences constituted the afternoon program with discussion on the following subjects—

(1) Airplane Performance and Design Characteristics. Lateral control, flaps for landing and take-off, stability, spinning, means for reducing vertical motion due to gusts, take-off.

(2) Aerodynamic Efficiency and Interference. Effects on wing drag of rivets and surface roughness, drag of simple forms; compressibility; propeller performance; slipstream effect on wing and tail; wing-fuselage interference.

(3) Cowling and Cooling. Nose slot cowling flight research; aerodynamic efficiency of baffles; cylinder temperature correction factors for flight conditions; fin design; compressibility effects on cowling; cowling of in-line air cooled engines.

(4) Aircraft Engine Research. A proposed method for rating fuels; compression-ignition engine performance under altitude conditions; two-stroke cycle compression-ignition and spark-ignition engine performance; effect of inert gases on combustion of diesel oil; pressures within fuel tanks during dives; fuel discharge rates with short injection tube; mixture-ratio indicators.

(5) Seaplanes. Effect of span and location of stub wing; effect of certain changes in hull form; flow patterns of water over a flying boat hull; comparison of transverse and pointed-step hull; effect of chine flare; scale effect in tank tests.

(6) Rotorplanes. Effect of rotor blade tabs on control force; drag of autogiro rotor and of complete autogiro; effect on efficiency of decrease in ratio of blade area to swept-disk area of rotors; effect on efficiency of blade plan form; effect of rotor blade tabs on blade twist; effect of tabs on flapping motion of rotors; effect of tabs on efficiency; effect of blade section on rotor efficiency.

I L at ID

(Continued from page 21)

channel. Accordingly all signals, from main beacon and two markers are heard in the phones without switching.

For actuating the indicator instrument, filters are used to separate the three different tones. The 700 cycle tone from the outer marker is rectified and applied to a relay which operates a small lamp at the left of the indicator. The 1700 cycle tone of the inner marker likewise operates a lamp to the right of the indicator. The main beacon signal is delivered through a rectifier to the glide path indicator, which has two parts. The horizontal indication operates on the A and N signals. When on course there is no deflection of this pointer, but when off course it deflects with a jerking motion either left or right. The horizontal indication of the path is obtained by feeding the rectified 1150-cycle tone of the main beam to a pointer on the indicator which moves in the horizontal direction. When the automatic volume control is disconnected, the increasing signal strength operates the horizontal indicator as the plane approaches the main beacon transmitter.

The operation of the system

In using the system, the pilot comes within the near vicinity of the airport (within several miles) and picks up the main beam by circling through the A and N regions. Once on the beam, and heading for the airport, the approach is maintained by the avoiding aural and visual off-course signals. A height of about 700 feet is reached and held until the outer marker beacon is directly under the plane, as indicated by the flashing of the left-hand lamp and the low-pitched dashes in the phones. The pilot then begins losing altitude at a constant rate of descent reaching the inner marker (9000 feet from the outer marker) at an altitude of about 50 feet. When the inner marker signal is heard in the phones (high-pitched dots), and the right-hand lamp flashes, the actual glide to the runway is begun. In this method of landing the vertical indication is not used, the pilot relying simply on his knowledge of the distances involved between marker stations and the run-way and on the rate at which he is losing altitude. A switch is provided, however, whereby the automatic volume control is removed so that the vertical indicator comes into action. By keeping the vertical indicator centered, the pilot follows a route of constant signal strength which is in the form of a glide-path whose steepness diminishes as the ground is approached. This

(Turn to page 75)

I L at ID

(*Continued from page 72*)

type of vertical navigation is not too reliable, because of the many factors which can change the signal level followed, such as changes in transmitter power and receiver sensitivity, which are guarded against but which are difficult to eliminate entirely.

In the demonstration of the system, six or eight passengers were taken aloft at a time, and three crowded into the rear of the pilot's cabin to view the workings. The operation was substantially the same as indicated in the above description with a few minor exceptions, which made the demonstration less striking but were not significant otherwise. In the first place, the lamps on the indicator did not light, since their relay controls were set for the European system of dots on the right and dashes on the left, in contrast to the A-N system used in this country. This also affected the utility of the horizontal indication but had no effect on the vertical indication. The aural signals were very clear and definite, however, and in the demonstration they seemed to be used by the pilot in preference to the visual indicator.

The presence of strong north-west crosswind across the run way, a rare occurrance according to the authorities, made it rather embarassing for the demonstrators, since they could not complete any landings during the demonstration. A considerable degree of crabbing was necessary to hold the course down the beam, and a landing with that aspect would have been dangerous. Consequently the plane was brought within a few feet of the ground and then immediately lifted clear. This in no wey detracted from the performance of the equipment, but it did show one of the limitations of all blind-landing systems, namely the necessity either of portable equipment or of equipping two run ways (possibly two run ways in both directions) with the apparatus to adjust the landing beam to the prevailing wind conditions. The other school of thought says, of course, that heavy wind is very rare in 0-0 conditions, and that complete 0-0 is so rare that the pilot almost always sees the ground in time to head up the wind before landing. With heavy transport planes the latter maneuver is to say the least difficult. In any event the question of wind-direction was emphasized in the Indianapolis tests, and it must be answered before the problem is finally solved.

Comparison with other I-L systems

The concensus among many of the engineers present was that the Lorenz system is not very different from the Bureau of Standards System or the newer Washington Institute of Technology, not at least in principle. The method of establishing the guide beam with vertically-polarized di-poles and reflectors is a departure, since the B. S. system used a miniature localizer similar to the radio range antenna system. And the operating frequencies of the Lorenz system, are lower, 33 and 38 Mc. compared with 91 Mc. in the B. S. system. These are apparatus differences only, and have but little effect on the operation of the system as a whole. The Lorenz system has been very carefully built, and the consistency of operation of the transmitters, their stability and interlocking, and the elaborate monitoring system are all improvements which will probably be incorporated in all future developments. But the same weaknesses apply to the Lorenz system as have to all previous attempts. One is the wind-direction problem previously referred to. The other is the unsatisfactory state of the vertical glide-path indication, which is subject to error, and even when operating perfectly, not very easy to follow with the plane. The fact that the horizontal indicator gives but little idea of the *amount* by which the ship is off the beam is also a limitation, only partly relieved by the fact that the signal gives some indication of the amount of left or right deviation. And the continuous navigation problem in which the pilot must indulge, just when things are thickest, is not to be laughed off lightly.

But the day is not far off, for all that, when major airports will be fitted with regularly operating I-L equipment. Just what form it will take, or what new improvements will appear to remove the difficulties mentioned, is not clear at present. The Indianapolis demonstration showed progress, especially in the equipmentation of the system. But we still wait, in this writer's opinion, for the final answer.

Lockheed Model 14

(*Continued from page 34*)

system to be equally serviceable with the electric operated retracting system.

In preparing for production of the Model 14 we made renewed comparative studies of structural materials and of fabricating methods. As a result we have adopted extruded sections on a wider scale. In this connection we have developed a new economy through punching complete rows of rivet holes in extruded stringers in one operation. These extruded strips then serve directly as drill jigs for the drilling of rivet holes in the skin. We have also found the use of forgings on a wider scale to be more economical in cost and weight than castings. Especially when forgings can be ordered for one hundred or more planes at a time the savings are appreciable.

In organizing production of the Model 14 we were both helped and hindered by the fact that our factory was being expanded and re-organized. Such confusion as existed hampered some phases of early production, but new buildings and a re-location of departments has made it possible for us to lay out the various production units in ideal relation to each other so the long term result will no doubt be beneficial.

We have gone the limit in building up "workable" jigs for all parts of the plane. The fuselage jig permits twenty men to work on the fuselage at once and others are in proportion.

In the handling of all problems of engineering and production design the greatest credit for creative work and constructive cooperation belongs to James Gerschler, assistant chief engineer; Clarence Johnson, chief research engineer; Carl Beed, project engineer; and Charles Thomas, chief stress analyst. Of course we are proud of the complete teamwork existing throughout the plant from Robert E. Gross, president, right through to the newest apprentice. By cooperation, by fore-thought, and by intense concentration on the problem of speeding production from the day the word "Go" is given to the engineering department we believe that we have come a long step forward in bringing high speed production to the manufacture of high speed aircraft.

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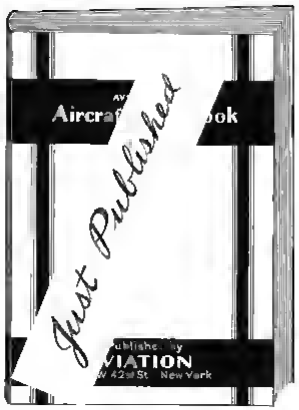

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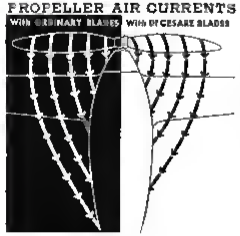

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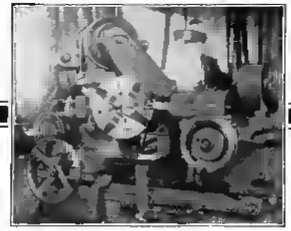

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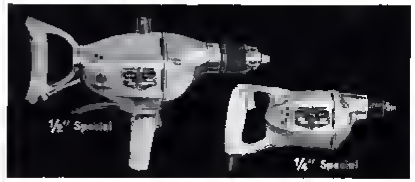

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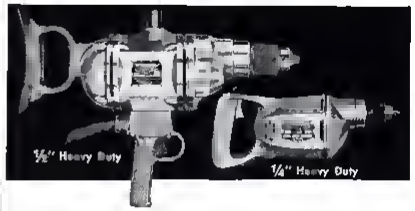

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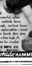

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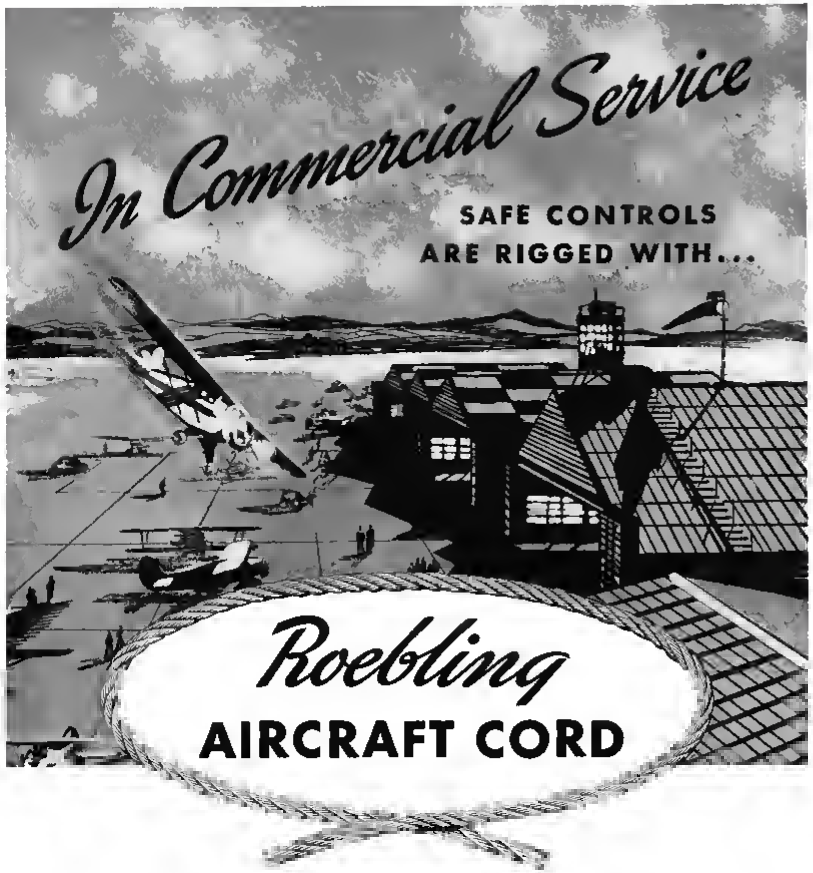

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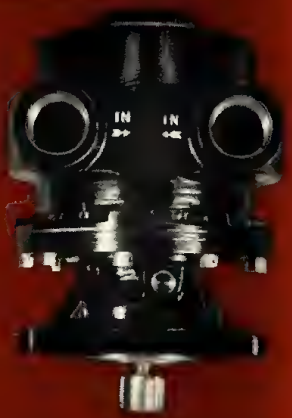

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